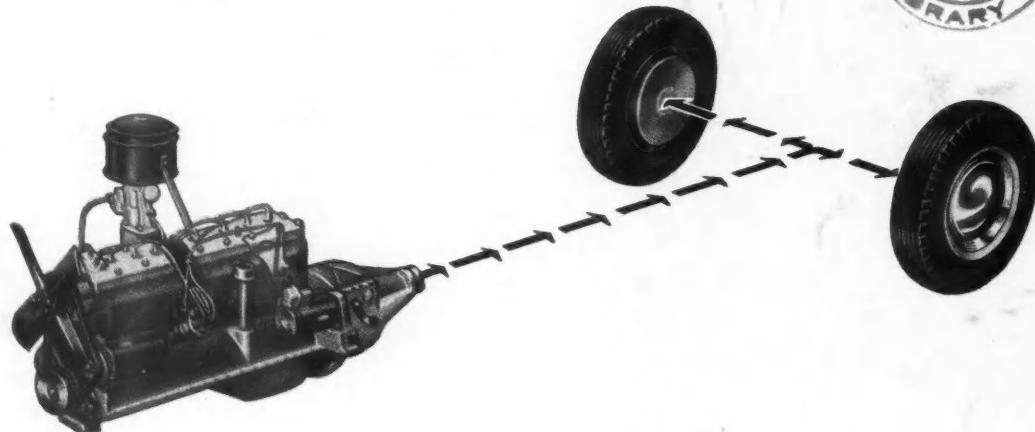


AUTOMOTIVE and Aviation INDUSTRIES

FEBRUARY 1, 1947



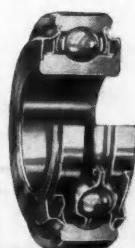
Don't dissipate the power

of your engine, on its way to the wheels.

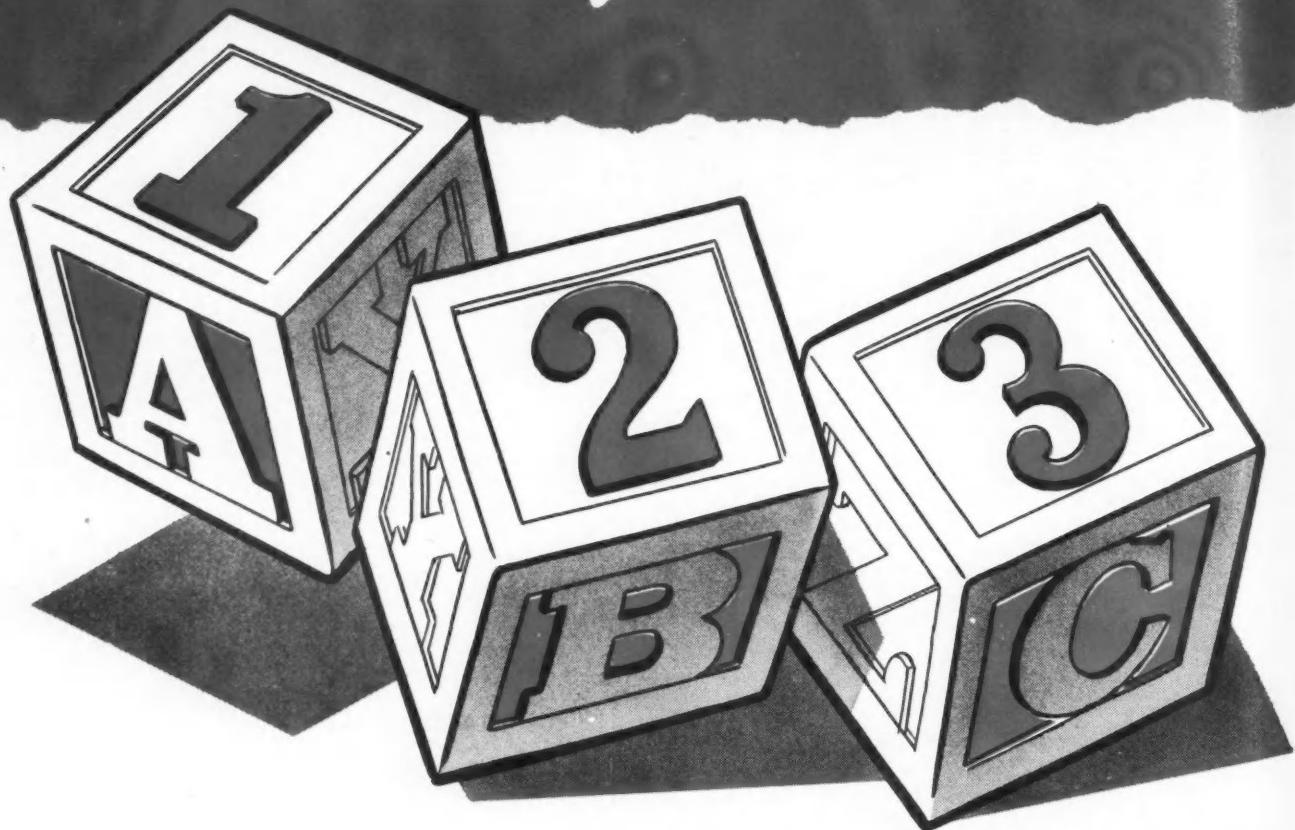
Use New Departure Ball Bearings,

because —

nothing rolls like a ball.



It's as easy as...



to use coded lubrication

1 Why you need it. Standard's Coded Lubrication provides one of the simplest known methods for helping oilers determine what lubricant is needed at every lubricating point in your plant. It helps them avoid errors in filling oil cans, grease guns and other dispensing equipment. It eliminates the need for their learning a great number of detailed instructions and grade numbers of lubricants.

2 How it works. All lubricants used in the plant are assigned numbers. A number is applied to each storage container or dispensing unit indicating the lubricant it contains. Each spot to be lubricated is also marked by an easily applied decal numbered to indicate the lubricant required.

3 What it does! The results you get with Coded Lubrication make it well worth while. It reduces breakdowns resulting from the application of wrong lubricants. It prevents application of costly lubricants where ordinary lubricants can be used. It simplifies training of oilers.

A Standard Oil Lubrication Engineer will fully explain Coded Lubrication and its application to your plant. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**

AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

February 1, 1947

Vol. 96, No. 3

JULIAN CHASE, Vice-Pres. and Directing Editor
 J. R. CUSTER, Associate Editor
 JEROME H. FARRIS, Ass't Editor
 MARCUS AINSWORTH, Statistician
 JOHN C. HILDRETH, JR., Research
 L. W. MOFFETT, Washington Editor
 E. J. HARDY, Washington News Ed.
 R. RAYMOND KAY, Pacific Coast Editor
 JOS. GESCHELIN, Detroit Editor
 H. H. ROBERTS, Ass't Editor
 ROBERT C. MACK, Ass't Editor
 LEONARD WESTRATE, News Editor, Detroit
 HOWARD KOHLBRENNER, Art Editor
 KARL RANNELS, Washington News Ed.

CONTENTS

This Could Be a Three Billion Dollar Parts Year. By Clarence O. Skinner	17
International Establishes New Truck Pricing Policy	18
Buick Cylinder Blocks Now Machined on First Unitized Transfer Line. By Joseph Geschelin	20
Lifting the Secrecy Lid on Bendix System of Direct Fuel Ignition	28
Meaty Ideas from the SAE Annual Meeting	30
Electronic Ignition System in Experimental Stage. By Alfred J. Poole	37
Waukesha Adds Four New Diesel Models	38
Advanced Type of Temperature Control for Buses and Trucks	40
New Production and Plant Equipment	41
Linn Delivery Coach	44
New Products	45
News of the Industry	48
Calendar of Coming Events	54
Advertisers' Index	124

Copyright 1947 by Chilton Company (Inc.)

G. C. BUZBY, President and Manager Automotive Division
 E. H. MILLER, Adv. Mgr. E. W. HEVNER, Cir. Mgr.
 REGIONAL BUSINESS MANAGERS
 JOHN T. HOOLE, Chicago HARLAND E. BOYD, Cleveland
 E. E. ELDER, Detroit A. R. ECKEL, New York
 NELSON W. SIEBER, Philadelphia C. H. WOOLLEY, San Francisco
 AUGUST HAURIN, JR., Los Angeles

OFFICES
 Philadelphia 39, Pa., Chestnut & 56th Sts., Phone Sherwood 7-1424
 New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600;
 Chicago 1, Ill., Room 916, London Guarantee & Accident Building, Phone
 Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison
 2090; Cleveland 14, Ohio, 1030 Guardian Bldg., Phone Cherry 4188; Wash-
 ington 4, D. C., 1061 National Press Bldg., Phone District 8109 and 8110;
 San Francisco 5, Calif., 605 Market St., Room 608, Phone Sutter 4951;
 Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.
 Cable Address Autoland, Philadelphia

Member: Audit Bureau of Circulations; Associated Business Papers, Inc.
 AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Merchant (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY (INC.)

Executive Offices
 Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A.
 Officers and Directors
 Jos. S. HILDRETH, President

Vice Presidents
 EVERIT B. TERHUNE P. M. FAHRENDORF JULIAN CHASE
 THOMAS L. KANE G. C. BUZBY CHARLES J. HEALE
 WILLIAM A. BARBER, Treasurer JOHN BLAIR MOFFETT, Secretary
 HARRY V. DUFFY T. W. LIPPERT FRED V. COLE

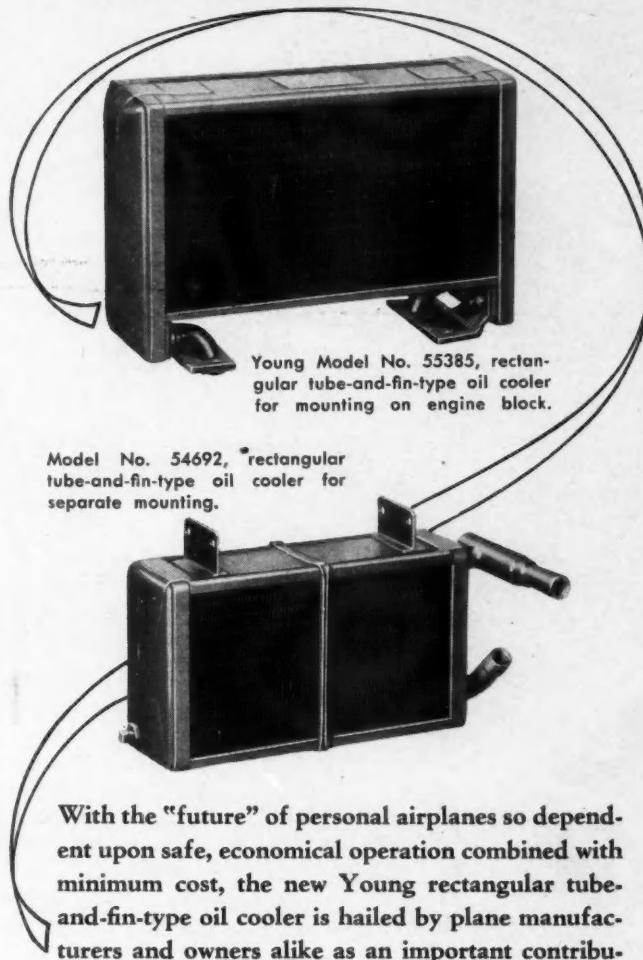
WILLIAM H. VALLAR, Ass't. Treas.

PAUL WOOTON, Washington Member of the Editorial Board

February 1, 1947

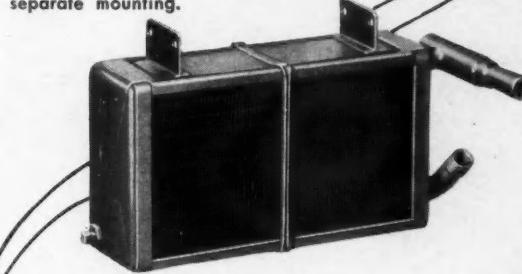
When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

YOUNG PRESENTS NEW LIGHT-WEIGHT OIL COOLER FOR PERSONAL PLANES



Young Model No. 55385, rectangular tube-and-fin-type oil cooler for mounting on engine block.

Model No. 54692, rectangular tube-and-fin-type oil cooler for separate mounting.



With the "future" of personal airplanes so dependent upon safe, economical operation combined with minimum cost, the new Young rectangular tube-and-fin-type oil cooler is hailed by plane manufacturers and owners alike as an important contribution toward meeting such requirements. These new coolers are 50 percent lighter, 75 percent less costly than the conventional round cellular-type aircraft oil cooler. Models available have capacities to properly cool engines from 75 to 220 H.P. size. Construction details include: provision for thaw-out; internal agitation; designed cores for maximum heat transfer at minimum weight.

Here is another example of Young's ability to apply specialized heat transfer engineering to the critical needs of a highly specialized industry. Consult the Young Engineering Staff today.

YOUNG HEAT TRANSFER PRODUCTS

OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • HEAT EXCHANGERS
 INTERCOOLERS • EVAPORATIVE COOLERS
 GAS COOLERS • UNIT HEATERS
 CONDITIONING UNITS • EVAPORATORS
 AND A COMPLETE LINE OF AIRCRAFT HEAT TRANSFER EQUIPMENT

YOUNG RADIATOR CO., Dept. 217 B RACINE, WIS., U.S.A.

AUTOMOTIVE and AVIATION INDUSTRIES, Vol. 96, No. 3. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign \$5.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

Engineering Library

PREVENT RUST!

A machine tool manufacturer found, when operating one of his machines continuously day in and day out with a turbine grade mineral oil, that sludging of the hydraulic system resulted after 500-700 hours of operation. By switching to Texaco Regal Oil (R & O) he was able to increase the period between drains to 2400 hours, with no sign of gum, sludge or varnish.

The hydraulic system of a broaching machine operating 22 hours a day had to be dismantled every two weeks to clean rust and deposits from pistons and valves in order to get the machine to run smoothly and with the proper speed. After changing to Texaco Regal Oil (R & O) the same machine ran for 90 days between drain periods with no indication of trouble.

PREVENT SLUDGE! IN HYDRAULIC MECHANISMS

TEXACO Regal Oils (R & O) are designed to lick the biggest bugaboo of hydraulic mechanisms — the costly stoppages caused by rust and sludge. They are specially inhibited against rust and oxidation.

The rust inhibitor in Texaco Regal Oils (R & O) "plates" all parts of the hydraulic system so that moisture cannot reach and rust the metal. The oxidation inhibitor aids the oil in freeing itself rapidly of air and water and thus prevents sludge formation. In addition, Regal Oils (R & O) will not

foam — extra assurance of smooth, dependable operation.

Leading makers of hydraulic equipment either ship their units filled with Texaco Regal Oils (R & O) or recommend their use. There is a complete viscosity range to assure trouble-free, economical performance from every hydraulic mechanism, large or small.

For full information, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 E. 42nd St., N. Y. 17, N. Y.



TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

Tune in . . . TEXACO STAR THEATRE presents the NEW EDDIE BRACKEN SHOW every Sunday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

Some High Spots of this Issue

Will 1947 Be a \$3 Billion Parts Year?

It may be if essential raw materials are available in sufficient quantities and in steady flow and automobile production reaches 5,000,000 units as it could. Clarence O. Skinner of A.A.P.M. states the facts of past experience and speculates on future possibilities. His article starts on page 17.

Another Top Secret of Wartime Engineering Is Disclosed

Here is the first release of details of the Bendix Direct Injection Fuel System which gave added power and punch to our B29s and other planes in the latter part of the war and thereby helped materially to clinch a hard-won victory. It is now decreasing fuel consumption and increasing pay-load of commercial airliners. It will be found on page 28.

Combined Automatic Temperature Control For Both Man and Motor

A new heating and ventilating system for buses and trucks which also gives their engines more heat when they need it as when warming up, when idling or when shut off in cold weather. Not only more comfort for the driver and his passengers but less crankcase dilution, sludging, and corrosion of cylinder barrels. See page 40.

A Thousand Foot Machine Line Which Automatically Processes Cylinder Blocks

Buick's new, modernized manufacturing facilities employing the first unitized transfer line which reduces manual handling to a minimum are fully described for the first time beginning on page 20.

Nut-Shell Presentations of New Ideas Disclosed At the Annual SAE Meeting

How light can the light car be? Metering fuel in response to variations in rpm, intake manifold pressure and temperature, and exhaust back pressure. Microscopic measurement of cylinder wear during short operating periods. Adapting fittings to sandwich structures. New method of measuring engine knock. Requirements in propeller design for personal planes. Checking valve cam profiles with an oscillograph. And that's only a few of those that are to be found beginning on page 30.

Comprehensive Interpretation of General News Of the Industry Beginning on Page 48

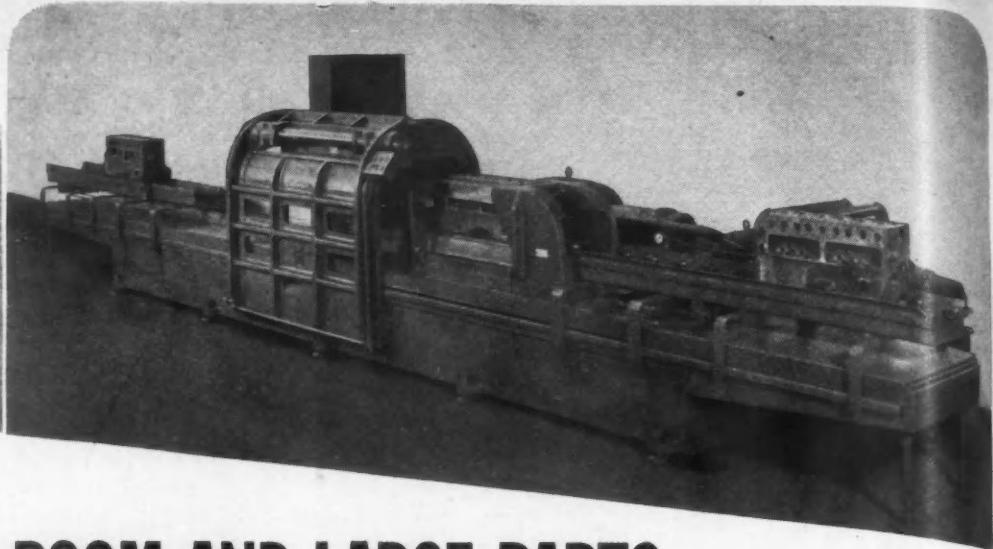
For Complete Table of Contents See Page 3

**AUTOMOTIVE
INDUSTRIES**

Reg. U. S. Pat. Off.



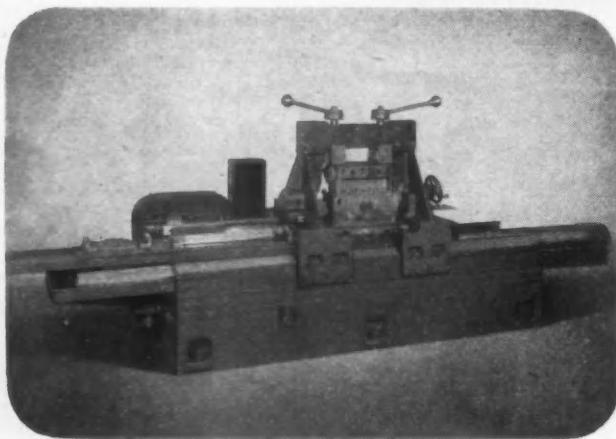
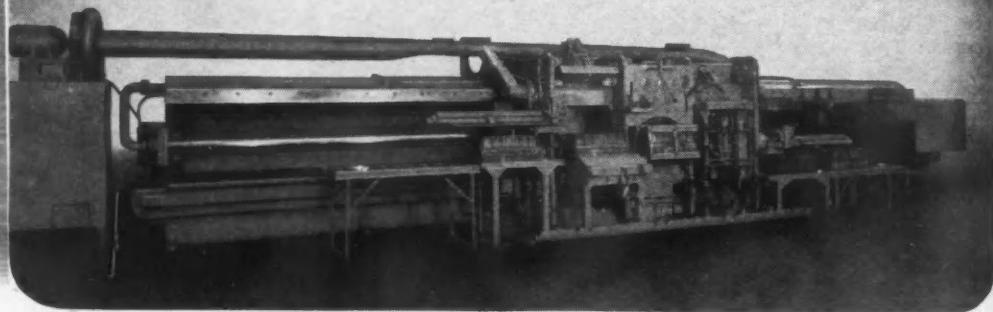
CINCINNATI Horizontal Hydro-Broach Machine for finish broaching cylinder head gasket surface.



LOW HEAD ROOM AND LARGE PARTS CALL FOR . . .

HORIZONTAL SURFACE BROACHING MACHINES

CINCINNATI Horizontal Hydro-Broach Machine for broaching five surfaces on cylinder blocks . . . half-bore, bottom, top, push rod and distributor pad surfaces.



CINCINNATI Horizontal Hydro-Broach Machine for finish broaching bearing locks.

● In many shops, the advantages of broaching can more readily be attained with horizontal rather than vertical machines. Three cases that might be mentioned are: 1) where there is not much head room, due to low ceilings or traveling cranes; 2) where ample floor space is available at low rental rates; 3) where parts are large and heavy. Of course there are other conditions, too, in any number of instances, and all of them have been met successfully with CINCINNATI Horizontal Hydro-Broach Machines. ● Three cylinder block installations are shown here. (Note: This type of broaching need not be confined to cylinder blocks and heads.) Our Application Engineers will be glad to study your requirements and recommend the most economical methods and equipment.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES

AUTOMOTIVE and
AVIATION INDUSTRIES

By Clarence O. Skinner

Washington Representative,
Automotive and Aviation Parts Manufacturers, Inc.

This Could Be a

Three Billion Dollar Parts Year

If Raw Materials Are Available

THE greatly increased demand for replacement parts as compared with prewar demand is creating and will continue to create a total industry requirement for raw material never before experienced. The 1941 sales volume of original equipment parts (exclusive of bodies, bolts, nuts, screws and the parts made by the vehicle manufacturer for use in his own product) was approximately \$1,295,000,000, or \$253.50 per new vehicle manufactured. The sales volume of replacement parts was \$599,000,000, making the total parts sales volume \$1,894,000,000 (U. S. and Canada).

If we now set up the 1946 and 1947 sales volume of original equipment and replacement parts for the United States on the basis of 1941 prices, the relationship of these estimated sales volumes to the 1941 sales

volume will give a rough estimate of material requirements in relation to 1941 material usage.

The accompanying table shows this relationship. The 1946 new vehicle production was nearly 3,000,000. For 1947 we have made the estimate on the basis of an annual production of three different quantities of new vehicles; namely, 3,200,000, 4,000,000 and 5,000,000.

About 2,000,000 less new vehicles were produced in 1946 than were produced in 1941, resulting in a corresponding reduction in original equipment parts volume. However, the replacement parts volume is approximately 250 per cent of 1941. In 1946 the parts industry (original and replacement combined) used about 19 per cent more raw material than the total used in 1941.

If 5,000,000 new vehicles are produced in 1947 and the replacement parts requirements are met, 18 per cent more raw material will be required than was used in 1946—40 per cent more than in 1941. If, on the other hand, 5,000,000 new vehicles are produced in 1947 and no more raw material is available than was used in 1946, only 70 per cent of the replacement parts estimated to be required in 1947 can

(Turn to page 60, please)

Original Equipment and Replacement Parts Estimates for 1947

Year	New Vehicle Production	Original Equipment Volume	Replacement Volume	Total	Per Cent Increase Over 1941
1941	5,109,000	\$1,295,000,000	\$ 599,000,000	\$1,894,000,000
1946	3,000,000	760,500,000	1,484,000,000	2,244,500,000	19
1947	3,200,000	811,000,000	1,446,000,000	2,257,000,000	19
1947	4,000,000	1,014,000,000	1,408,000,000	2,422,000,000	28
1947	5,000,000	1,267,500,000	1,390,000,000	2,657,500,000	40

International Establishes

New Truck I

INAUGURATING a new pricing policy with the announcement of its 1947 truck line, International Harvester Co. will base the price of most models not on minimum specifications but on the combinations of equipment most frequently specified by the majority of IHC users. Accordingly, the 1947 KB line of basic vehicles is composed of standard models featuring combinations of engines, axles, tires and other items generally wanted by the majority of customers.

This policy has resulted in many price adjustments, mostly upward, although there are some decreases. Such adjustments range from two per cent to something over 10 per cent and effect an overall increase of about five per cent. As an example, the base price of the former K-8 model was \$2500. But the great majority of this model was sold equipped with the 361 cu in. engine and with 9.00 by 20 or larger tires. With this equipment, the old model sold for \$2810. The price of the new KB-8 will be \$3150, including the 361 cu in. engine and 9.00 by 20 tires as standard equipment. This is an upward adjustment of \$340, but included in the new price are improved front and rear axles, wider base rims, and many other improvements.

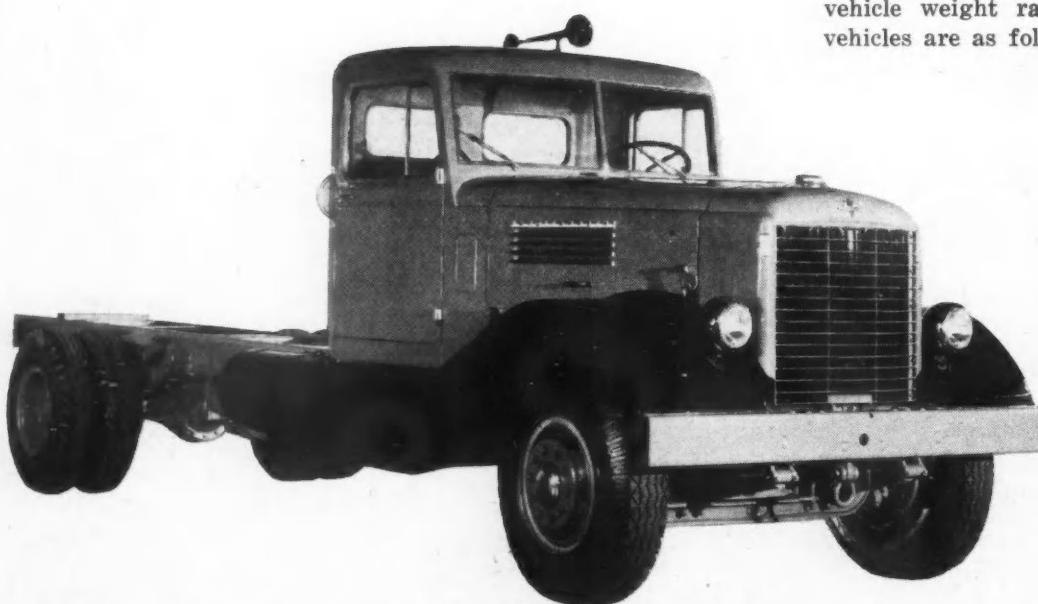
The base price of the former KR-11 model, a heavy

duty truck, was \$4970. But the great majority of this model sold were equipped with the following items, needed for proper operation: Timken axle, \$380; 450 engine and F54 transmission, \$185; and 10.00 by 20 tires, \$66. So equipped the old model sold for \$5601. The new KBR-11 model will be equipped with the Timken axle, the 450 engine and F54 transmission and the 10.00 by 20 tires as standard equipment, and will sell for \$5500. This is a reduction of \$101 below the price of the old model similarly equipped.

Although it may be said that the accent is on basic models incorporating practically maximum specifications regardless of price competition, the 1947 IHC line exemplifies modernity and freshness of styling consistent with the serviceability of heavy-duty motor trucks and includes many detail improvements both in sheet metal and mechanical design.

Fifteen basic models constitute the "KB" line. These together with six "W" or Western models built specifically for West Coast operating needs, provide a range of 21 basic models which are said to provide engineered units tailor-fitted to any specific requirements by means of adaptations and conversions available to the customer.

Five "KB" models, in the light-duty range and one medium-duty unit, are produced at the Springfield, Ohio, works. These are the light-duty KB-1, KB-1-M, KB-2, KB-3 and KB-3-M, and the medium duty KB-5. Gross vehicle weight ratings of the light-duty vehicles are as follows: 4400; 4600; 5200;



This highway-transport unit, model W-3042-H, is one of six basic models ranging from 30,000 to 90,000 lb gvw for both highway and off-highway use recently announced by the International Harvester Co. These heavy duty models offer a choice of two gasoline and three diesel engines, eight transmissions and four auxiliary transmissions.

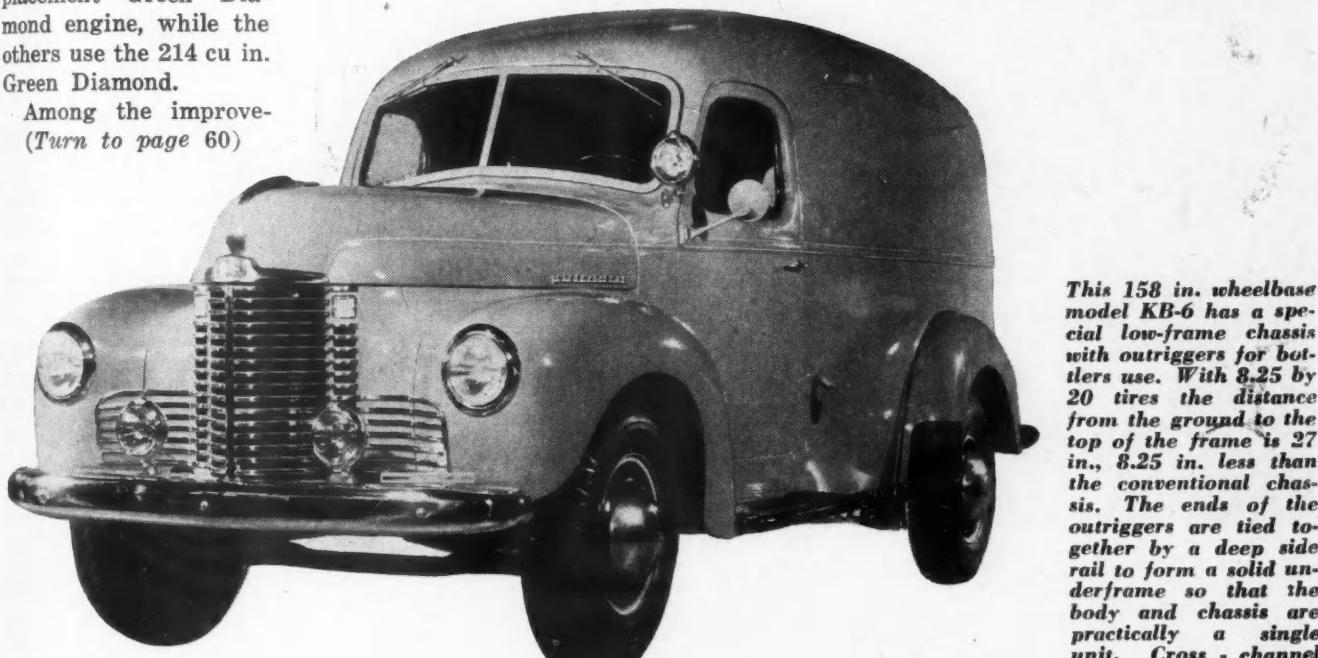
K Pricing Policy

IHC Introduces Six Western Highway
and Off-Highway Models in Its

1947 Line

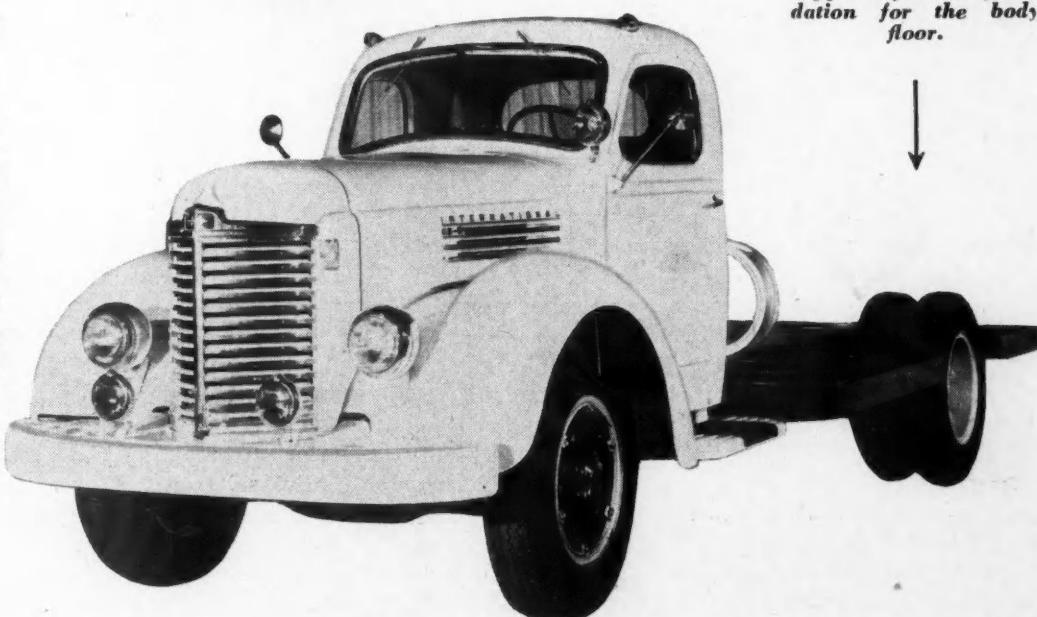
6650; 7000. The gvw. rating of the KB-5 is 18,500 to 17,500 lb, depending upon load, type of service and operating conditions. Wheelbases range from 102 to 195 in. The KB-5 is equipped with the 233 cu in. displacement Green Diamond engine, while the others use the 214 cu in. Green Diamond.

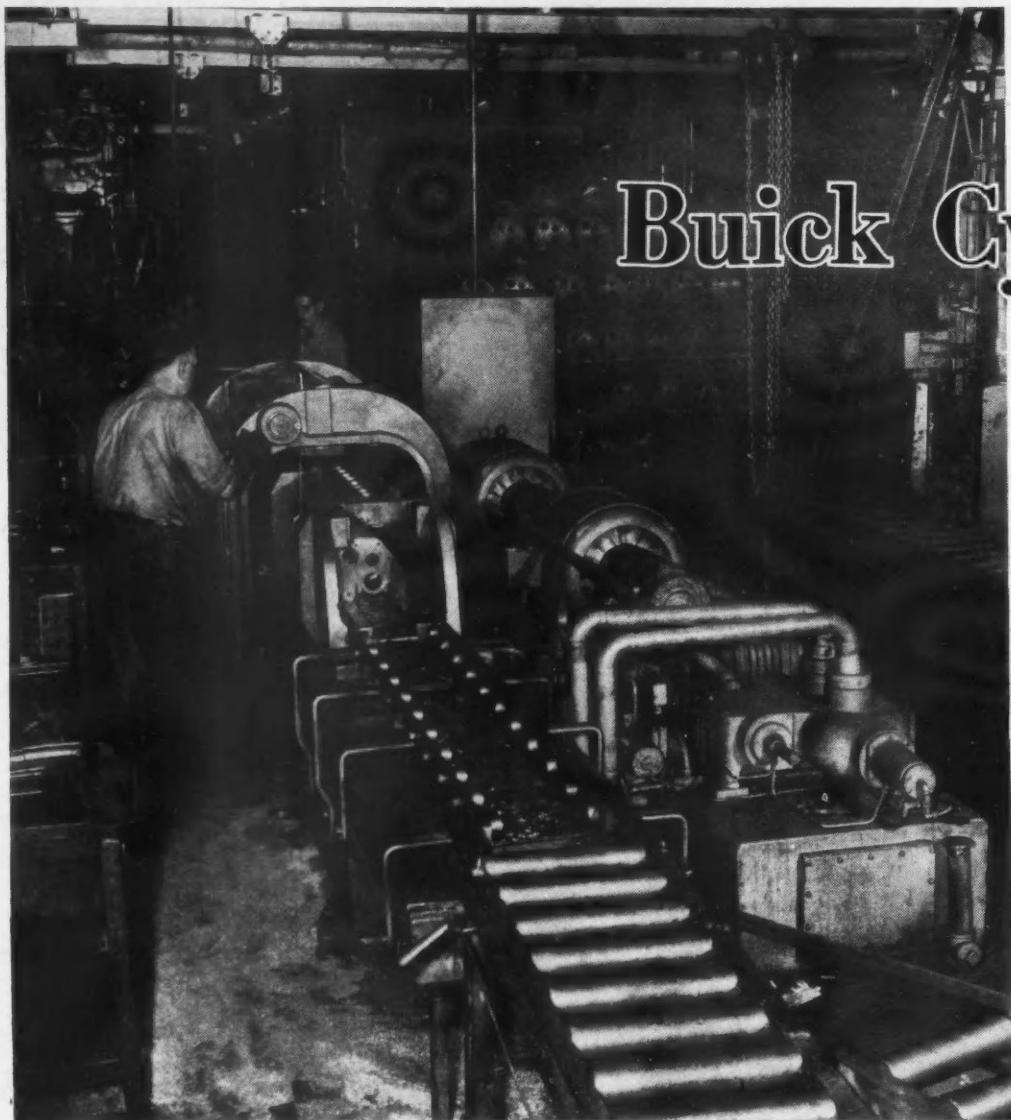
Among the improvements (Turn to page 60)



This 158 in. wheelbase model KB-6 has a special low-frame chassis with outriggers for bottlers use. With 8.25 by 20 tires the distance from the ground to the top of the frame is 27 in., 8.25 in. less than the conventional chassis. The ends of the outriggers are tied together by a deep side rail to form a solid underframe so that the body and chassis are practically a single unit. Cross-channel supports form a foundation for the body floor.

Powered with a six-cylinder Green Diamond engine which develops 82.4 bhp at 3400 rpm with a 3.3125 in. bore and 4.125 in. stroke, the KB-3 model shown here has a 130 in. chassis and a gross carrying capacity (cab, body and payload) of 3600 lb. The panel body is 109.375 in. long at the floor, 56 in. high, and has a capacity of 171 cu. ft.





Buick Cylinder B

By
Joseph
Geschelin

Reconditioning of the cylinder head surface, after most machining stages have been completed, is done by surface broaching in this Cincinnati horizontal Hydro-Broach.

MUCH has been said in recent years about the adoption of advanced machinery of transfer type as a means of increasing productivity and lowering prime cost. Through the courtesy of Buick management we are able to present briefly the high spots of one of the first major changes in manufacturing technique to be found in the industry—the transfer process line for the machining of cylinder blocks.

When Buick resumed civilian production at the end of the war, its reconversion problem was greatly complicated by two major objectives. Its prime objective was to build as many 1946 motor cars as could be produced from scratch in the face of conversion and shortages. The long range objective, however, was to modernize manufacturing facilities by the erection of new buildings, and the introduction of machinery and methods of advanced type designed to increase productivity at lower cost and with improved quality.

A fresh concept of quality had a marked influence upon the selection of machinery in the engine department. For one thing, engineering specified unusually

fine tolerances on roundness of cylinder bores and demanded a special type of surface finish for the improvement of ring and bore life. This led to the adoption of the newly-developed Ex-Cell-O vertical precision boring machines which follow rough and semi-finish boring in the new Ingersoll boring machines. In addition, Buick was the first and only producer in 1946 to use the Parko-Lubrite process for coating cylinder bores. It is recognized in the industry that such coatings promote an excellent break-in surface and encourage compatibility of rings and cylinder wall surfaces.

Examination of the floor plan reproduced here shows the integration of the block machine line from start to finish in a continuous progression. However, a special effort was made by the master mechanic's department to break up the process into a succession of individual transfer type machines so as to avoid the complication of a single completely automatic machine. Most of the machines are of familiar type, proved by previous experience, to avoid the hazard of untried mechanism. Referring to the floor plan, the reader

Blocks Now Machined on First Unitized Transfer Line

***This Automatic Handling Process and Other Modern Techniques
Incorporated in Reorganized Manufacturing Facilities***

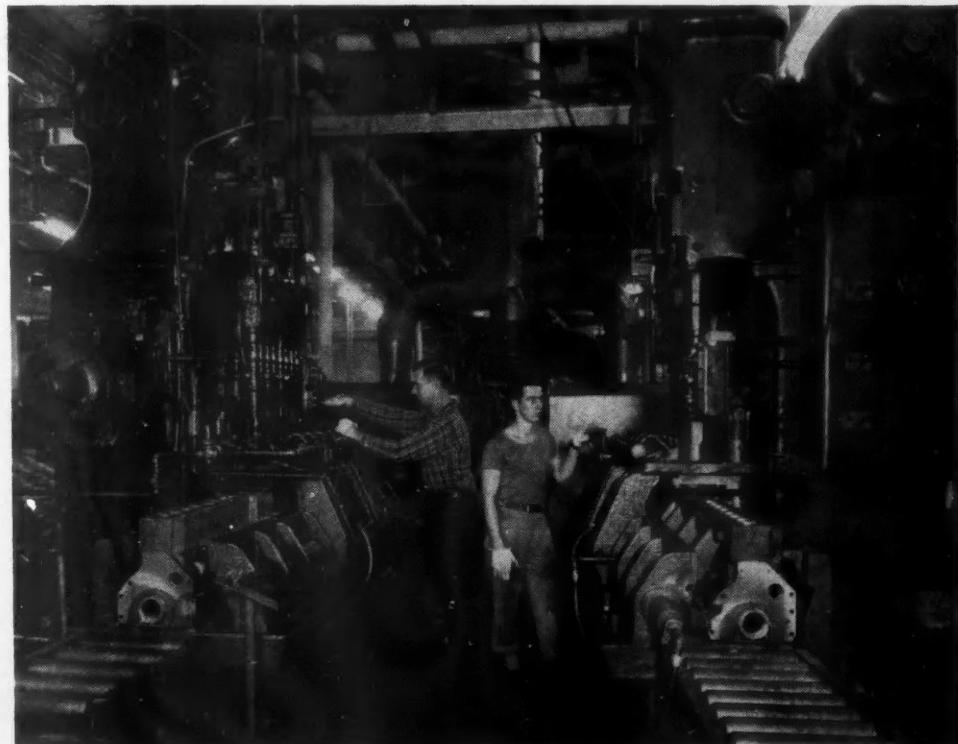
will find that each of the machines in the line is a self-contained and automatic unit connected to the next operation by a short length of gravity roller conveyor. This enables the operator to examine the work before he loads it onto the next automatic fixture station. In certain cases, they have provided an automatically-operated roll-over fixture to turn the work into proper position for loading. The objective is to reduce manual handling, to relieve the operators of the usual task of handling the work in and out fixtures, and to eliminate clamping of work by the operator. The result is a thousand-foot machine line in which practically every detail of the operation is performed by the machines rather than the workers, thus permitting them to concentrate upon quality and the performance of their machines.

To supplement the floor plan, we have reproduced a summary of the sequence of operations from start to finish. This will enable the reader to visualize the small group of key stations along the line and contrast this

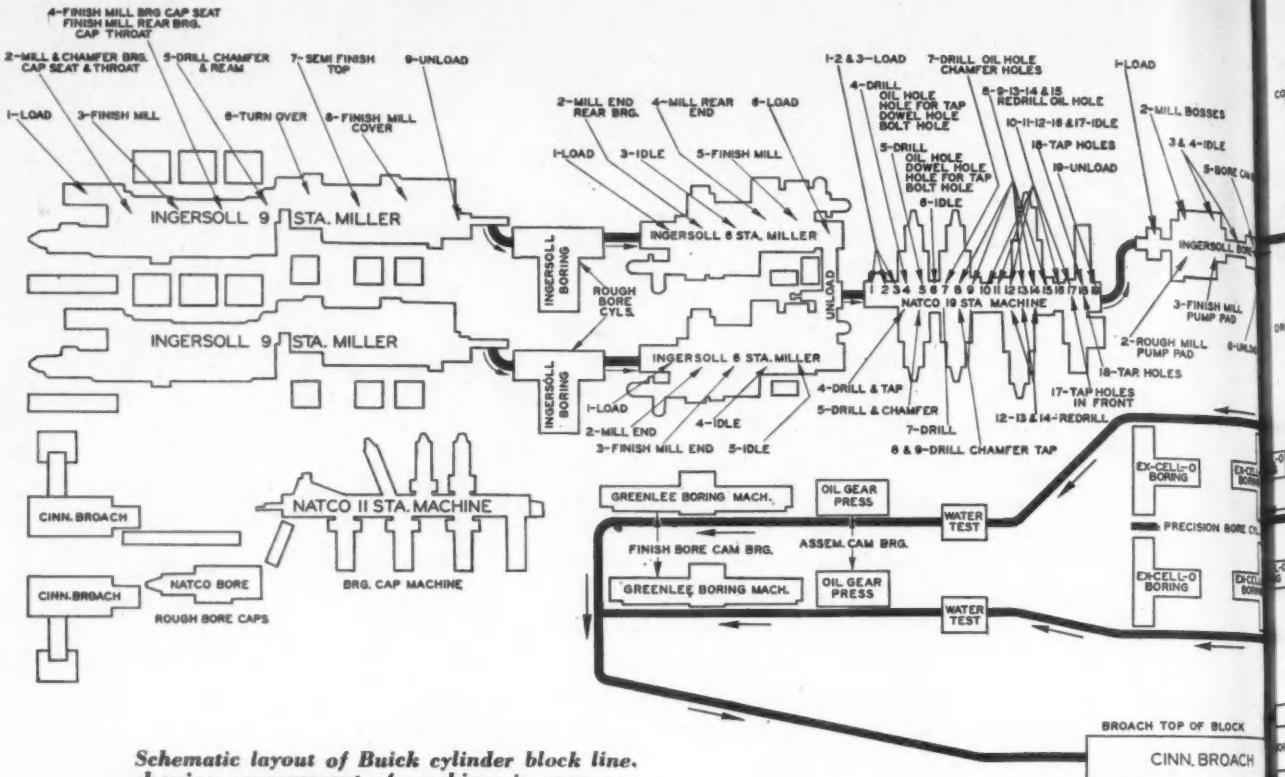
plan with the complexity of conventional layout.

Since operations are balanced in keeping with the goal of hourly output, there are duplicate machines on certain of the operations as shown on the floor plan. This is true of all operations that have a relatively slow cycle. For example, the precision boring of cylinder is so exacting that it takes six of the eight-spindle Ex-Cell-O machines to maintain desired flow. In most cases there are two machines for each station and this is true of the Parko-Lubrite operation which requires two separate process conveyor lines.

(Next page, please)



Following Parker - Lubrizing,
the blocks are given a final lap
in these two eight-spindle
Barnesdrill honing machines
fitted with cast-iron laps. These
machines, as well as the other
pair for honing are fitted with
automatic loading and unloading
fixtures.



*Schematic layout of Buick cylinder block line,
showing arrangement of machines in sequence
of operations.*

In processing the block particular attention was given to the proper sequence of metal removal operations so as to eliminate distortion. Transfer machines are so arranged as to clamp and unclamp automatically; and to clamp and unclamp for each stage of heavy metal removal. This is particularly important in the case of the first operation machine—the Ingersoll nine-station process milling machine. There are two of these machines in the line. The operator simply pushes the block onto the conveyor with the block resting on its top surface. From that point on machine operation is completely automatic. The block is clamped and un-

clamped automatically, turned into various positions automatically while in the given station. This is considered to be beneficial in relieving the strains of heavy metal removal.

Unique feature of this machine is the high feed rate using special Ingersoll Shear-Clear milling cutters tipped with cemented-carbide. Horizontal feed of work through the machine is at the rate of 43 inches per minute which is said to be exceptionally fast and is credited to the Shear-Clear milling principle. The sequence of operation through this machine is as follows:

First Station—Load.

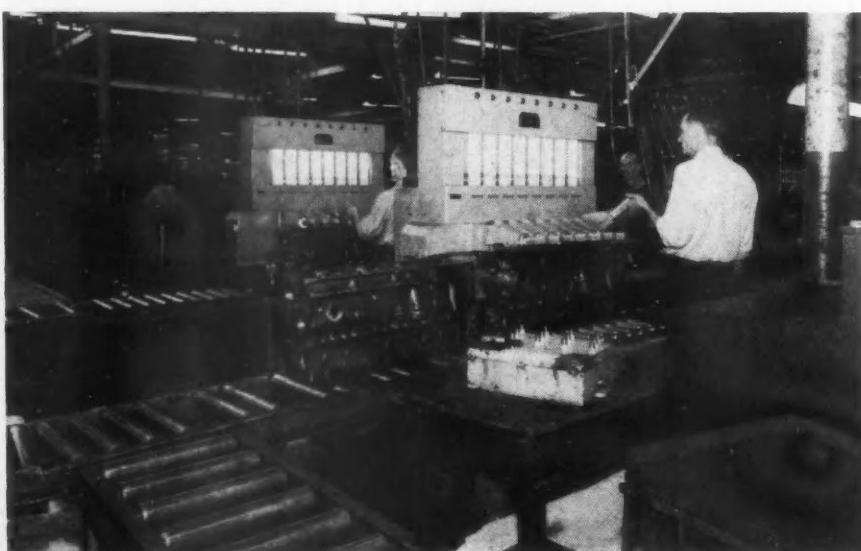
Second Station — Rough mill pan rail, bearing cap seats and rear bearing cap throat.

Third Station — Finish mill pan rail.

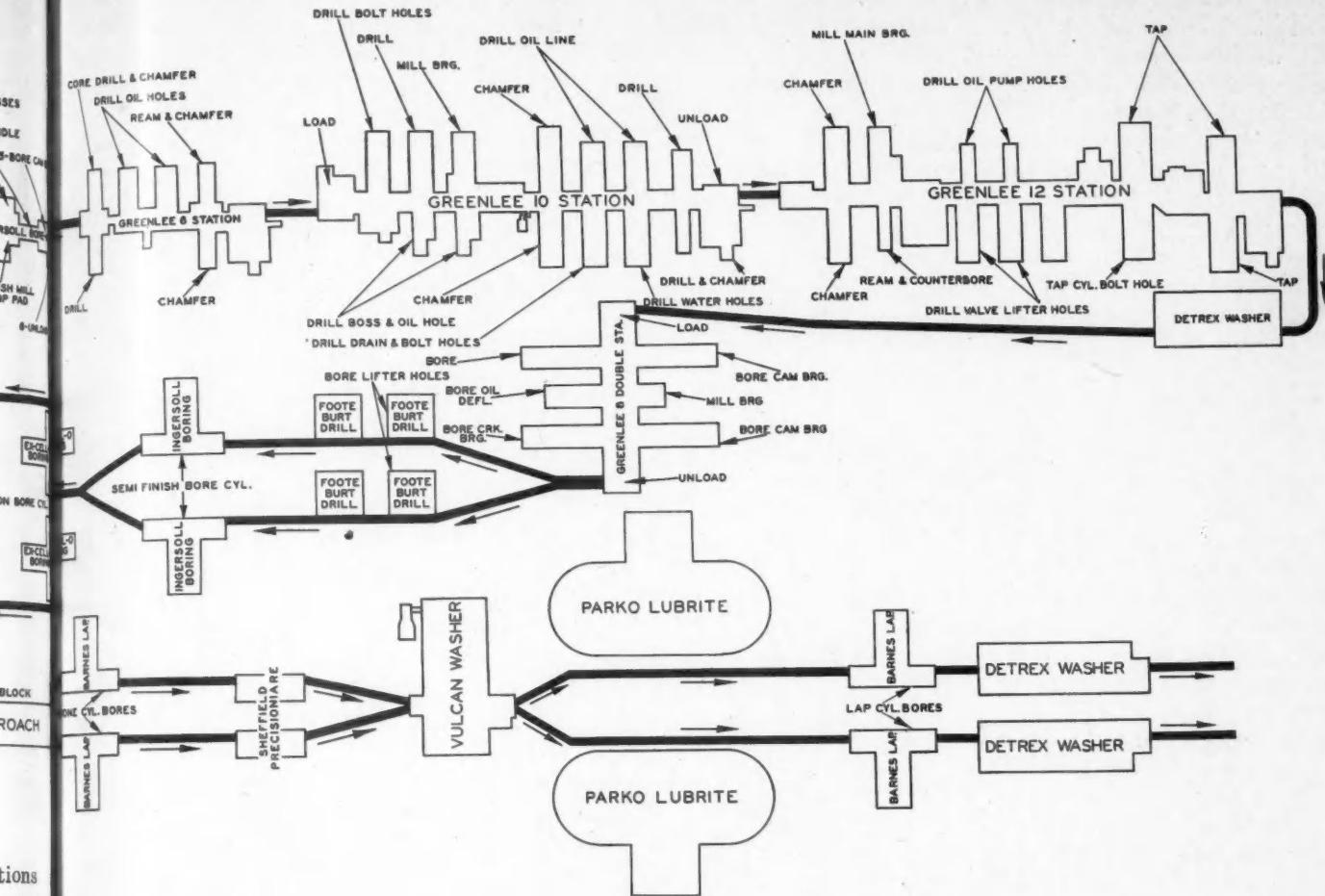
Fourth Station — Finish mill cap seats for depth, semi-finish mill for width. Finish mill rear bearing cap throat and shave bearing cap seats for width.

Fifth Station—Drill, chamfer, and ream locating holes.

Sixth Station—Turn over fix-



Here are two of the eight-station Sheffield Precisionnaire gaging machines for sizing bores in preparation for selective piston fitting. The handles used for stamping bore size may be noted in horizontal position directly above the head of the block.



ture, placing part on four pads added to welch plug side for manufacturing purposes.

Seventh Station—Rough and semi-finish mill top.

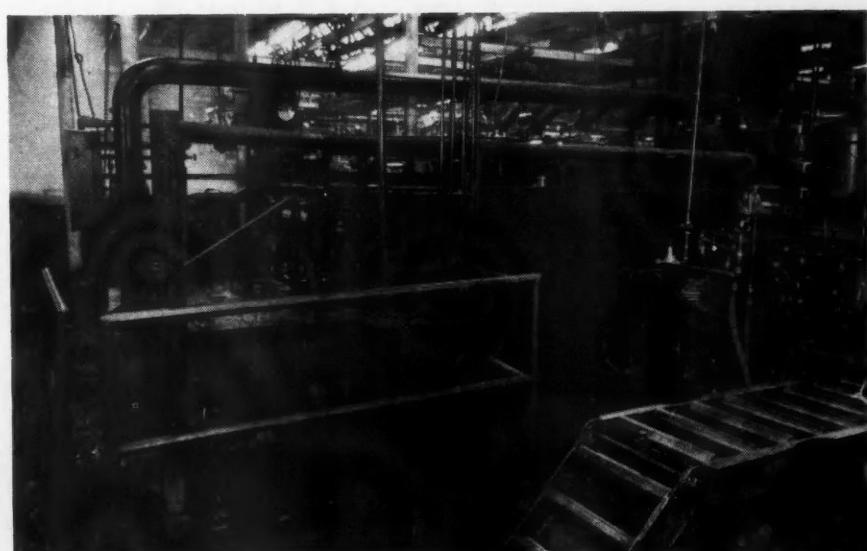
Eighth Station—Rough and finish mill valve cover side.

Ninth Station—Unload (1) part pan rail down.

It may be noted at this point that each of the machines on the line is separated from its neighbor by a three-foot section of gravity roller conveyor. This provides ample space for examining the block before an operator starts it on the next operation.

Second operation is the rough-boring of cylinder bores in a new eight-spindle vertical Ingersoll boring mill. It is provided with a three-station, automatically-operated fixture, which is typical of other machines in the

line. In each case, the operator pushes the block into the conveyor, the conveyor then picks up the work and moves it into the work station where the block is properly aligned before the operation starts. Finally the conveyor transfers the block out of the machine, ready for the next machine. In this case, the block comes from the preceding operation with pan rail down.



Built directly into the process line is this Vulcan automatic cycle washing machine for cleaning cylinder bores and main and cam line bearings.

For the third operation the work goes to the Ingersoll six-station process milling machine for rough- and finish-milling of both ends. This one, too, features high speed milling and uses the Shear-Clear, cemented-carbide-tipped cutters. Here the work is fed in sideways, the machine being so arranged that the right hand heads mill the front end while the left hand heads mill the rear end with a planetary head to clear the rear bearing projection. It is of interest to find that the heads on both sides are staggered with respect to each other, the result being that only one end of block is cut in a given station. This was done deliberately to prevent deflection of the block while milling. According to Buick this method of milling ends assures positive squareness of the ends with respect to the pan rail surface.

The block leaves this machine with the pan rail down and is moved by the operator into the 19-station Natco automatic line transfer machine arranged with heads for drilling, chamfering and tapping all holes in both ends. Unique feature of this machine is the step-by-step drilling of the 32-in. long oil gallery hole. It is drilled progressively at each station, with longer drills as the job moves from station to station, thus speeding the operation and relieving the individual drill of the usual heavy load. The sequence through this machine is as follows:

First Station—Load.

Second, Third Stations—Idle.

Fourth Station (left)—Drill rear end: (1) 0.593 oil gallery hole, (1) 0.368 holes for $7/16 \times 14$ tap, (1) 0.468 flywheel housing dowel holes, (2) 0.468 flywheel housing bolt holes.

Fourth Station (right) — Drill front end: (1) 0.1875 diameter oil hole, (2) 0.3437 dowel holes, (5)

0.316 holes for $\frac{3}{8}$ tap.

Fifth Station (left)—Drill: (1) 0.593 oil gallery hole, (1) 0.368 hole for $7/16 \times 14$ tap, (1) 0.468 flywheel housing dowel hole, (2) 0.468 flywheel housing bolt hole.

Fifth Station (right)—Combination drill and chamfer, (1) 0.316 hole for $\frac{3}{8}$ tap.

Sixth Station—Idle.

Seventh Station (left)—Drill: 0.593 oil gallery hole, chamber (2) 0.368 holes.

Seventh Station (right)—Drill: (1) 0.593 oil gallery hole.

Eighth Station (left)—Drill: (1) 0.593 oil gallery hole.

Eighth Station (right)—Drill: (1) 0.593 oil gallery hole, chamfer (6) 0.316 holes for $\frac{3}{8}$ tap.

Ninth Station (left)—Drill: 0.593 oil gallery hole.

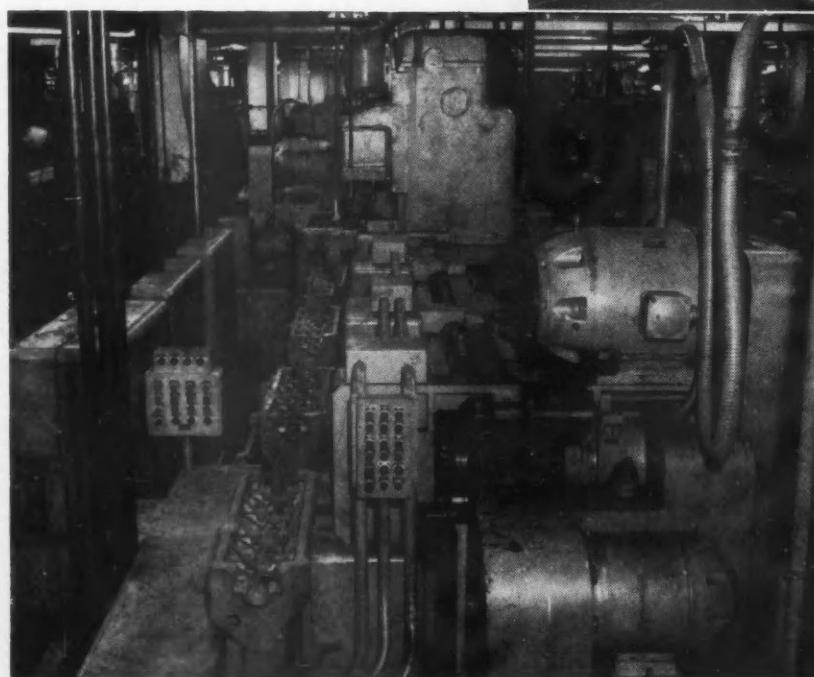
Ninth Station (right)—Drill: 0.593 oil gallery hole, chamfer (6) 0.316 holes for $\frac{3}{8}$ tap.

Tenth Station (left and right)—Idle.

Eleventh Station (left and right)—Idle.

Twelfth Station (left)—Idle.

Twelfth Station (right)—Drill: 0.593 oil gallery hole.



Above a better perspective of the Ingersoll process machine is found taken at erection and before shipment to Buick.

At the left is a front end view of enormous Ingersoll first-operation mill on the line—for milling top, bottom, valve cover side, and bearing cap seats; and the drilling and reaming of dowel holes. Blocks are loaded with the head down in the fixture as shown.

Thirteenth Station (left)—Drill: 0.593 oil hole—
gallery.

Thirteenth Station (right)—Drill: 0.593 oil gallery
hole.

Fourteenth Station (left)—Drill: 0.593 oil gallery
hole.

Fourteenth Station (right)—Drill: 0.593 oil gallery
hole.

Fifteenth Station (left)—Drill: 0.593 oil gallery
hole.

Fifteenth Station (right)—Idle.

Sixteenth Station (left and right)—Idle.

Seventeenth Station (left)—Idle.

Seventeenth Station (right)—Tap: (7) $\frac{3}{8}$ x 16 holes
in front end.

Eighteenth Station (left)—Tap: (2) 7/16 x 14 holes
and (1) $\frac{1}{4}$ x 18 oil gallery hole.

Eighteenth Station (right)—Tap:

(6) $\frac{3}{8}$ x 16 holes and (1) $1\frac{1}{4}$ x 18
oil gallery hole.

Nineteenth Station—Unload: (1)
part pan rail down.

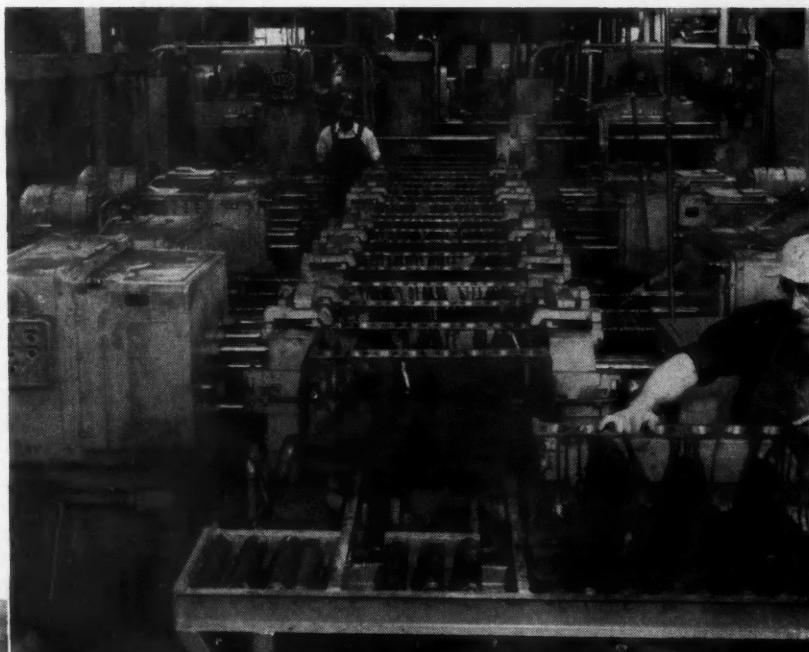
Blocks come out of the Natco with
the pan rail down and are moved into
the first station of the Ingersoll five-
station process milling and boring
machine. Here we find an automatic
turn-over fixture which indexes the
work so as to get the pan rail up and
leading with the rear end. The left
hand heads mill one of the motor
mounting pads and welch plug
bosses; while the right hand heads
mill the other motor mounting pad
and rough mill the fuel pump pad at
the second station and finish-mill at
the third station. The fourth station

does the rough-boring of the camshaft and crankshaft
lines. The last station is for unloading.

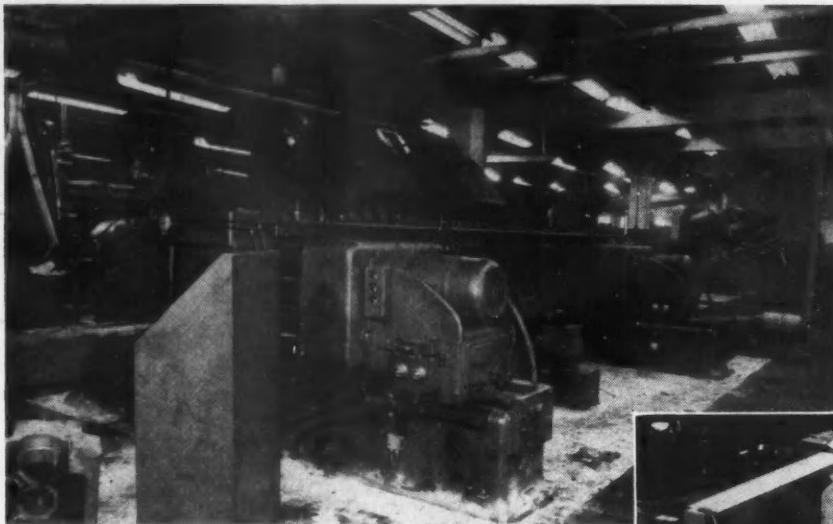
Unloaded with the rear end leading and pan rail up,
blocks are fed into a six-station Greenlee automatic
line transfer machine in which all of the detail holes
in the sides of the block are drilled, including the oil
lines from crankshaft to camshaft bearings. The ma-
chine has right and left hand heads for stations 2, 3, 4,
and 5; the first station being for loading while the
sixth is for unloading.

Work comes out with rear end leading and pan rail
up and is fed into the 10-station Greenlee automatic
line transfer machine for drilling and chamfering top
and bottom holes. The sequence of operations is as
follows:

First Station—Block automatically turned over on
welch plug side ready for drilling.



Natco Holeway process machines are shown above in an integrated unit for drilling, chamfering, and tapping both ends of the Buick block, including the step-by-step drilling of the long oil gallery. This 19-station unit is completely automatic in its action. At the left is an overhead view of the same Natco 19-station machine taken on the erection floor. This gives an even better impression of its size and arrangement.



Perspective view of the large Greenlee transfer machine for drilling, chamfering and tapping the sides, bottom, and top of the block is shown at the left. Below is a view taken on the erection floor, before shipment to Buick. This view shows the same Greenlee machine in clearer perspective.

Second Station (left)—Drill: (10) 0.4219 bearing cap bolt holes.

Second Station (right)—Mill: distributor number boss.

Third Station (left)—Drill: (28) 0.261 pan rail holes, (2) 0.316 oil pump mounting holes.

Third Station (right)—Drill: (1) 0.750 hole in distributor boss, (1) 0.3125 oil gage rod hole half way.

Fourth Station (left)—Mill: (5) bearing locks.

Fourth Station (right)—Drill: (1) 1.250 diameter hole in distributor boss, (1) 0.3125 oil gage rod hole through.

Fifth Station (left and right)—Idle.

Sixth Station (left)—Chamfer bottom of cylinder bores.

Sixth Station (right)—Chamfer top of cylinder bores.



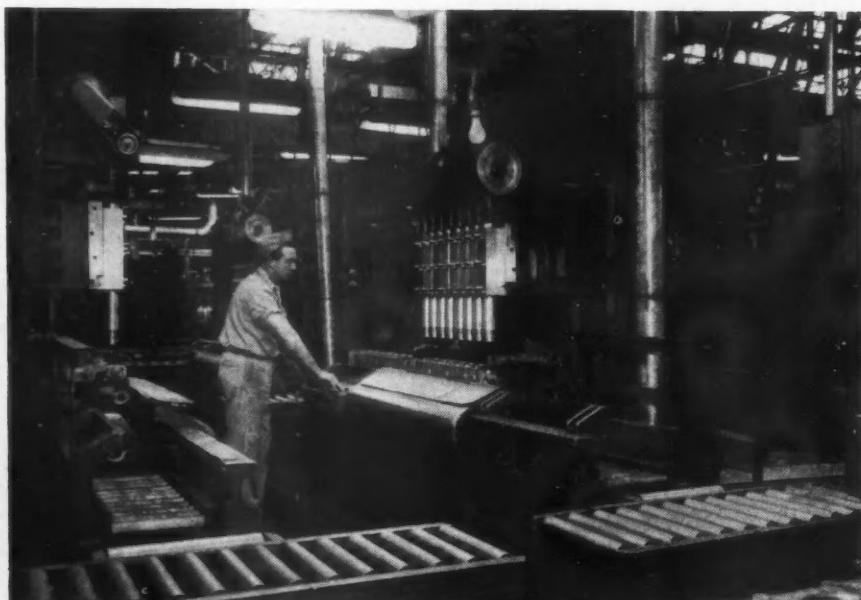
Seventh Station (left)—Drill: (5) 0.348 oil line hole halfway.

Seventh Station (right)—Drill: (22) 0.368 diameter cylinder head bolt holes, (1) 0.250 oil drain hole.

Eighth Station (left)—Drill: (5) 0.398 oil line holes through.

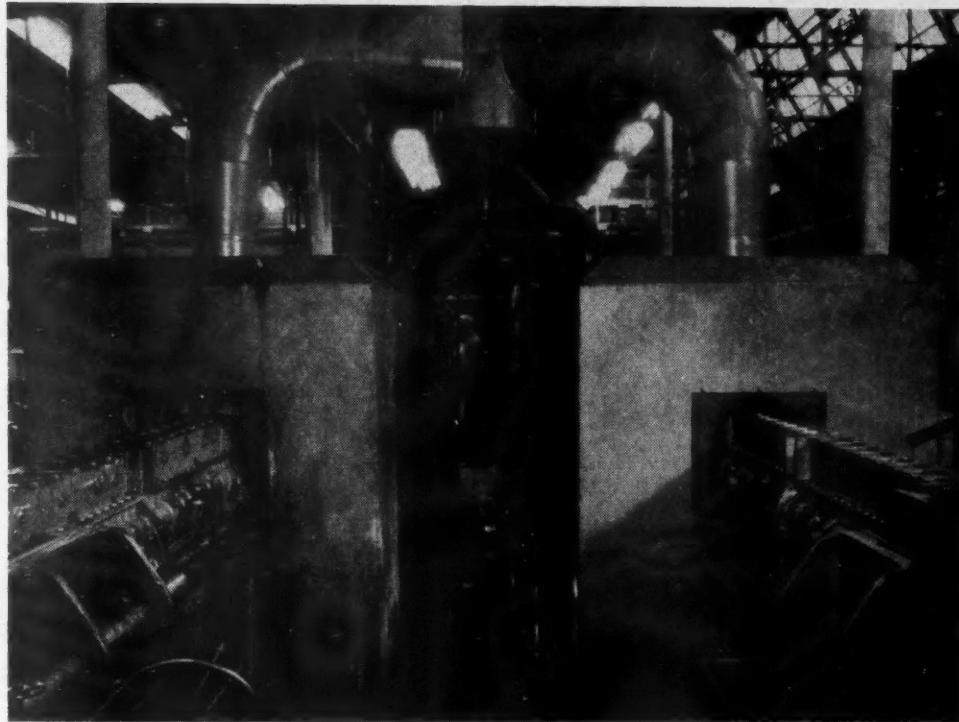
Eighth Station (right)—Drill: (4) 0.500 diameter water holes, (1) 0.3125 diameter water hole.

Ninth Station (left)—Drill: (1) 0.4531 water drain hole, (1) 0.250 diameter hole in distributor boss.



Here are two of a battery of newly developed Ex-Cell-O, 8-spindle vertical precision boring machines for cylinder boring. They hold tolerances of 0.0005 in. for both out-of-round and taper. Each machine is equipped with an automatic fixture for transferring blocks into position, hydraulically clamping and unclamping and transferring the case out of the machine.

Immediately following Barnes-drill lapping, blocks go through the large Detrex continuous washing machines shown in this view.



Ninth Station (right)

—Step drill and chamfer (2) 0.261 holes in distributor boss.

Tenth Station — Unload.

Upon emerging from the 10-station Greenlee the block moves directly into the 12-station Greenlee automatic line transfer machine for another group of drilling, reaming, and counterboring operations, including a milling operation at the third station as may be seen from the routing:

First Station—Load.

Second Station (left)—Chamfer: (28) 0.261 oil pan holes, (10) 0.4219 bearing cap bolt holes, (2) 0.316 oil pump mounting holes.

Second Station (right)—Chamfer: (22) 0.368 cylinder head bolt holes, (1) 0.250 oil hole—drain.

Third Station (left)—Rough mill oil deflector and packing, groove. Chamfer center main bearing.

Third Station (right)—Semi-finish ream and counter bore distributor holes.

Fourth Station (left and right)—Idle.

Fifth Station (left)—Drill: (1) 0.500 diameter oil pump hole halfway.

Fifth Station (right)—Drill: (16) 0.625 diameter

valve lifter holes halfway.

Sixth Station (left)—Drill: (1) 0.500 diameter oil pump hole through.

Sixth Station (right)—Drill: (16) 0.625 diameter valve lifter holes through.

Seventh Station (left and right)—Chip dumping fixture.

Eighth Station (left)—Idle.

Eighth Station (right)—T. C. T. Core Drill: (16) 0.375 diameter valve lifter holes.

Ninth Station (left)—Tap: (28) 5/16 x 18 oil pan holes, (10) 1/2 x 13 bearing cap bolt holes, (2) 3/8 x 16 oil pump holes, (5) 1/8 x 27 oil gallery line holes, (1) 1/4 x 18 water drain holes.

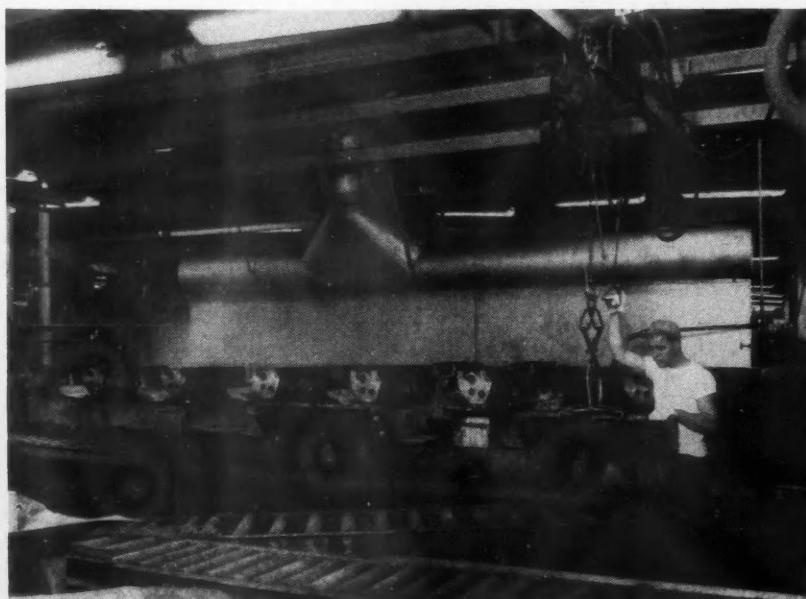
Ninth Station (right)—Tap: (27) 7/16 x 14 cylinder head bolt holes, (2) 5/16 x 18 distributor boss holes.

Tenth Station—Turn over fixture, place part pan rail up.

Eleventh Station (left) — Tap: (4) 3/8 x 16 motor mounting pad holes, (2) 3/8 x 16 generator boss holes, (1) 5/6 x 18 vent cover holes, (1) 3/8 x 18 vent hole.

Eleventh Station (right) — Tap: (4) 3/8 x 16 motor mounting pad holes, (2) 3/8 x 16 fuel pump holes,

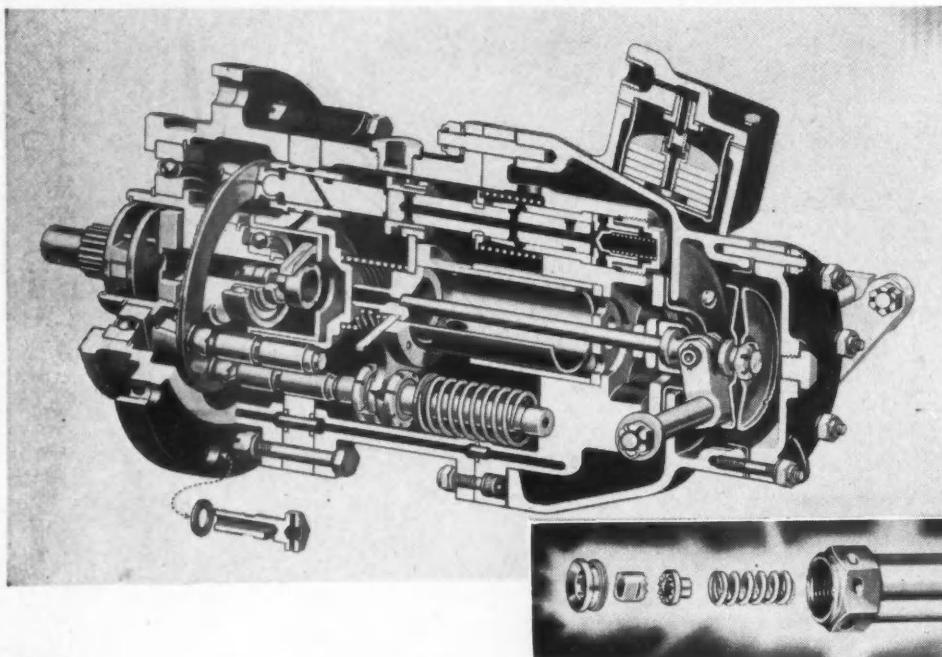
(Turn to page 62, please)



Above is one of the two merry-go-round conveyor lines for Parker-Lubritting of cylinder bores. This shows clearly the blocks already in place in the fixtures. The operator is ready to install another block, using the rail mounted hoist.

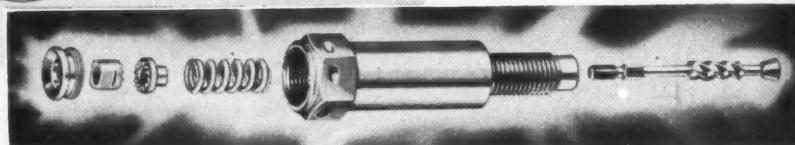
Lifting the Secrecy Lid

on Bendix System of



Cutaway view of the working parts of the fuel-injection pump of the Bendix direct fuel-injection system. Two of these single-plunger pumps are required for the fuel system installation on an 18-cylinder engine.

This is an exploded view of a discharge nozzle for the Bendix system. One nozzle is required for each cylinder of the engine.

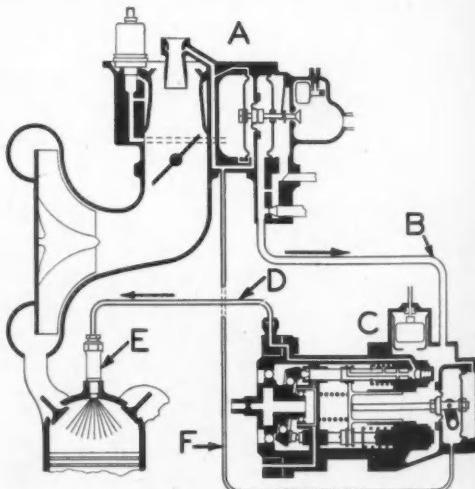


N

ow removed from the military secrecy list are the design details of the Bendix direct fuel-injection system, developed by the Bendix Aviation Corp., Products Div., for Army Air Force use during the war in high-output, multiple-bank, radial aircraft-engines operating at sub-stratosphere altitudes. Main element of the system is the injection pump which divides fuel received from a master control unit into equal parts, and delivers these equally divided quantities to the engine cylinders at timed intervals and at high pressure through discharge nozzles in the cylinder heads. With this method, the air and fuel are controlled separately, and are not mixed until they meet in the combustion chamber of the cylinder.

*The master control unit meters the fuel in the exact quantity required for the conditions of engine speed, load and altitude. Air is drawn into the induction system through the supercharger and blown into the combustion chamber through an independent system of manifolding. The discharge nozzles are connected to the injection pump through high-pressure, stainless-steel injection lines. The poppet-type nozzles open when the pressure in the injection lines is sufficient to overcome the force of the nozzle spring, and spray fuel into the engine cylinders during the intake strokes.

In the operation of this system, metered fuel leaving the



Schematic diagram showing the main elements of the Bendix direct fuel-injection system. Fuel is metered at the fuel control unit, A, and passes through line B to the injection pump, C, where it is divided into equal quantities and pumped through the line D to a discharge nozzle, E, where it is sprayed into a cylinder. Line F carries boost venturi suction from the air-intake.

By Joseph Geschelin

Direct Fuel Ignition

fuel control unit of the master control at from 6 to 7 psi, enters the injection pump (two for an 18-cylinder engine) through the inlet in the control shaft housing. Passing down through

the pump body, the fuel flows into the open ports in the plungers as the plungers move toward the lowest point of their stroke. As the plunger is moved upward by the rotation of a wobble plate, the center port in the plunger is covered by the plunger bushing, followed, in sequence, by the closing of the lower port by the by-pass sleeve, at which time the actual pumping operation begins. It should be noted that the by-passes are held stationary in relation to the movement of the plungers except when their position is changed by the action of the by-pass control plate for a change in throttle setting.

As the upward movement of the plunger builds up sufficient pressure (180 to 220 psi) to overcome the force of the check valve spring, the check valve opens, allowing fuel to flow into the injection lines. Further upward movement of the plunger compresses the fuel

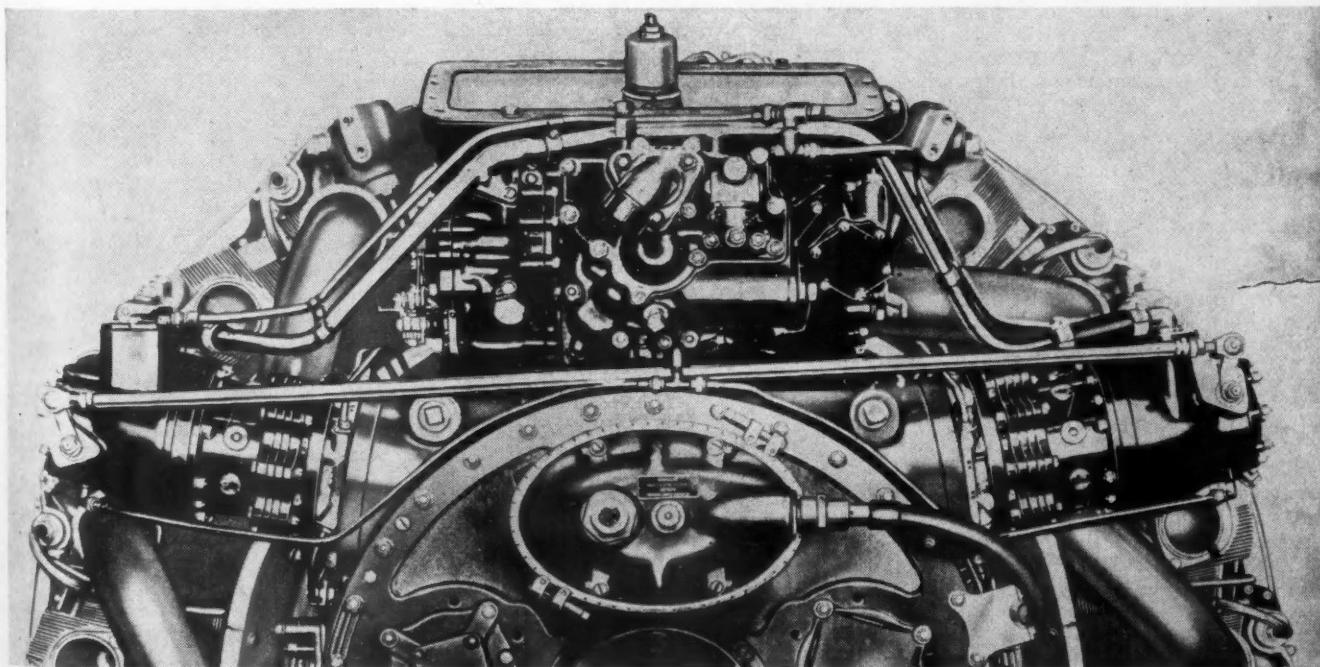
Design details of this important development released for first time

in the injection lines to produce the 500-psi hydraulic pressure required to open the cylinder head discharge nozzle and spray fuel.

Pumping action continues until the center port in the plunger is opened by the annulus and port in the bushing. The high-pressure fuel then escapes into the low-pressure area in the pump body. This relieves the pressure on the check valve, and the valve closes, stopping the flow of fuel to the engine. Fuel is thus trapped in the injection line, preventing the

(Turn to page 64, please)

The Bendix direct-fuel injection system is shown here installed on an 18-cylinder aircraft engine. The control unit is above, with the injection pumps at the right and left.



Meaty Ideas *from the*

Propeller Requirements for Light Aircraft

By John F. Haines,
Director of Research,
Aeroproducts Div.,
General Motors Corp.

FOR airplanes having low wing loading and relatively high power loadings, large take-off and climb improvement can be made by the use of controllable pitch propellers. Weight and cost considerations indicate the use of one of the simpler automatic two position designs. Small improvements may sometimes be adequate. If so, an improved fixed pitch propeller may be the cheapest and best solution. Re-rating of the engine may or may not be used as well, or a slightly higher power engine of different design used. This assumes a reasonably well balanced design in the first place.

For airplanes with higher wing-loading and lower power-loading, the use of controllable pitch propellers becomes a must to realize the performance of which such a design is capable. The use of a constant speed or selective pitch design will usually be warranted. Final decision must be based on cost and the degree of importance attached to cockpit simplification. In general, a higher order of pilot skill may be assumed than with lower performance airplanes.

For high performance airplanes, overall weight and cost of propeller and engine will be lowest for equal take-off performance using a controllable pitch propeller. Where the break will occur for lower performance designs will depend on how much propeller cost and weight can be reduced from present levels. On the basis of per hp per part per lb, cost of controllable propellers is considerably higher than engines. Weight is less out of line and less critical. Both cost and weight of the automatic propellers is minimum for flange rather than shaft mounting.

Standardization of mounting flanges is badly needed. The SAE standard flanges are not universally used by any means. Flanges designed for wood propellers are not the best for controllable designs. Present SAE flanges impose a weight penalty of about a pound on the smaller designs, around 85-100 hp. Present variation between different engine makers flanges will

impose a cost penalty as yet undetermined. The possible benefits of flange vs. shaft mounting for the larger designs has not been determined.

Efforts of small controllable pitch propeller manufacturers should be aimed at a cost of one dollar per hp or less. This should be for a two position automatic propeller up to about 150 hp and a constant speed up to about 250 hp. These two types should meet 90 per cent of airplane requirements for some time. Amphibious may be an exception in requiring reverse pitch. These basic designs should not be complicated by provisions for feathering or reverse pitch.

NACA Study of Measurement Of Piston-Ring Radial Pressure Distribution

By Milton C. Shaw,
Charles D. Strang,
and Ormal W. Hart.
National Advisory Committee for
Aeronautics

A MULTIPONT piston-ring gage has been developed at the Cleveland laboratory of NACA. This instrument uses 12 equally spaced force-measuring units to compress the piston ring to a circle of cylinder diameter. The force-measuring element was designed to have a relatively large displacement

accompanying the measurement of a given load to insure stability with respect to vibration and other external disturbances. Means of adjusting each load-measuring element individually were provided to compensate for the displacement accompanying the load imposed by the piston ring. Fig. 1 is a diagrammatic sketch showing the principle of operation and one of the force-measuring elements of the gage. The piston ring is positioned in the gage at approximate cylinder diameter by the slotted guide. Advancing the force-measuring elements radially inward transfers all the ring force from the guide to the force-measuring elements. Exact cylinder diameter for the ring is assured by a master disk and a system of neon tubes. A neon tube indicates lack of contact between the piston ring and the guide.

The force-measuring system consists of a guide block mounted on guide rods and radially adjusted by a graduated micrometer screw in which back-lash is taken by preloading springs. The dynamometer spring is a heat-treated beryllium copper ring having a spring constant of approximately 1080 psi. Strain introduced in this ring by the force transmitted to it by the piston ring is measured accurately by a wire resistance strain-gage bridge. The mounting of all four arms of the bridge

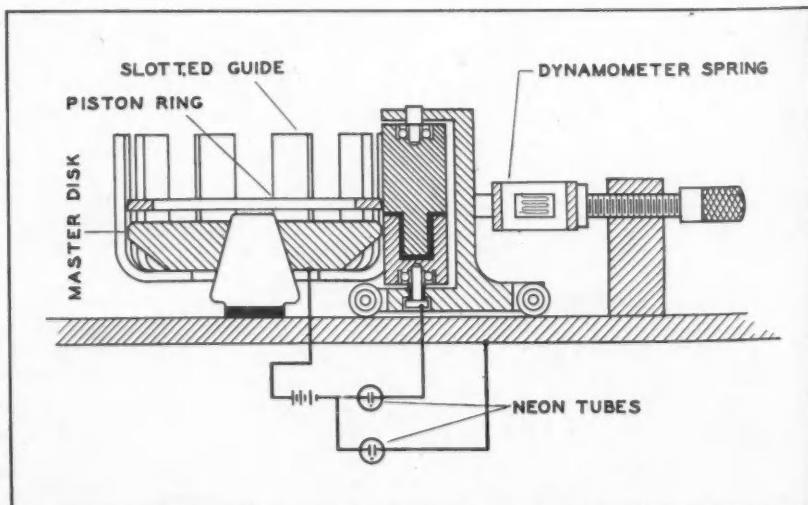


Fig. 1. Diagrammatic sketch of piston-ring gage.

SAE Annual Meeting

***Herewith are Concise and Pithy Abstracts
of Outstanding Papers presented***

circuit on the dynamometer ring insures complete temperature compensation. Maximum sensitivity is achieved by using two gages acting in tension together with two gages acting in compression so connected that their outputs are additive. The outputs from the individual bridge circuits are fed through selector switches to a calibrated self-balancing potentiometer. Auxiliary variable resistors are inserted in each bridge circuit to permit the potentiometer scale to be adjusted to zero when no load is applied. Small differences in the spring constants of individual dynamometer rings together with small differences in strain-gage sensitivity are neutralized by adjusting a variable resistor shunted across the slide wire of the self-balancing potentiometer.

It was found necessary to position radially the adjacent load-measuring elements to within less than 0.0001 in. if reasonable accuracy was to be achieved. A practicable method by which such fine adjustment may be accomplished is to use an internal standard and a means of compensating for the radial displacement accompanying the measurement of force. An equal increase of as much as 0.001 in. in the radial setting of all load-measuring units had little effect upon the radial-force distribution of a piston ring. A cylinder that is out-of-round by as little as 0.005 in. is capable of significantly affecting the radial-pressure pattern of a piston ring.

How Light is Light in the Passenger Car Field?

By W. D. Appel,
Willys-Overland Motors, Inc.

THE principal methods whereby weight and cost can be eliminated in the construction of motor vehicles are as follows:

1. Making the vehicle smaller is more effective in weight than in cost reduction since the main cost reduction is the saving in raw material. The cost of labor and tooling are not greatly affected.

2. Elimination of unnecessary parts shows a saving in weight as well as in material, labor and burden without affecting the commercial appeal.

3. Simplification of design or the elimination of unnecessary machining operations, while not necessarily affecting weight, is quite important from the standpoint of reducing the cost of labor as well as investment in tools and machinery. However, commercial acceptability should not be impaired.

4. Combining several functions into a single part, a combination of items

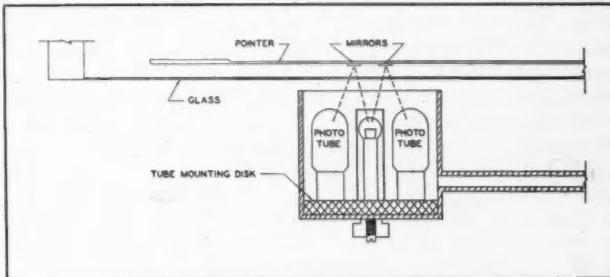
tional economy of operation within the time the average first buyer owns the car.

A Photoelectric Dynamometer Load Control

By M. R. Clapp,
The Lubrizol Corp.

Two eddy current dynamometers used to load the axles of a high-torque gear oil testing unit were found to cause some difficulties due to load varia-

Fig. 2. Sectional view showing operation of photoelectric dynamometer control.



2 and 3, is illustrated by the rear trunk lid handle, lock and license plate lamp combination used on some cars. Weight and cost are reduced while commercial acceptance may even be enhanced.

5. Using higher stresses is good practice provided stresses remain within safe limits. It offers a saving in weight and material cost without affecting other characteristics.

6. Using light metal alloys, the most publicized solution to the problem, allows a reduction in weight but at an increase in material cost. The use of light-weight alloys usually requires a new technique which is not commonly used in the motor car industry and which involves further increase in cost to cater to the different characteristics of the material. It is most useful when applied to income-producing vehicles such as motor buses, but in privately owned passenger cars the increased cost can rarely be amortized by the addi-

tions as a result of excitation voltage changes and fluctuations in water flow rate and temperature. To maintain a uniform load without constant attendance, a load control was developed using a pair of photo tubes to follow the load variations and make corrections through a motor driven rheostat in the dynamometer field.

Fig. 2 is a drawing of the photoelectric element showing the lamp, photo tubes, and the path of the light beam. Two small mirrors (0.18175 in. sq. and 0.03125 in. thick) are cemented to the pointer of the scale and reflect the light beam from the lamp to the photo tubes when the pointer interrupts the beam. Since the angle made by the line of centers of the photo tubes with the pointer may be varied by rotating the tube mounting disk, the period of coincident exposure of the two tubes may be adjusted as desired. It is by this adjustment that the

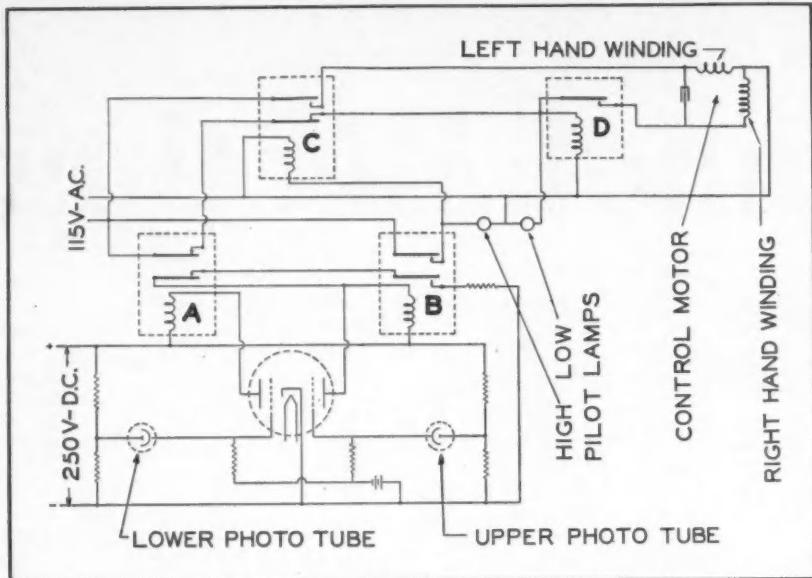


Fig. 3. Wiring diagram of photoelectric dynamometer control.

width of the control point and the sensitivity of the control are set. The control point is that period when the lower tube alone is illuminated. When the beam falls below the lower tube the load is increased by the motorized field rheostat until the control point is reached. If the load increases so that the beam falls on or above the upper tube, the load is decreased to the control point.

On the control panel are two pilot lamps for each dynamometer. These lamps flash when the load is above or below the control point and are off when the control is satisfied. Since the control motor has a speed of one rpm and has a maximum travel of one revolution, either of these lamps remaining on for more than a minute is a signal to the operator that the load change is outside the range of control and requires manual correction.

A schematic wiring diagram of the control showing the various relays between the photo tubes and the control motor, which amplify and keep in proper sequence the impulses from the photo tubes, is shown in Fig. 3. A double triode vacuum tube unit converts the change in resistance of the photo tubes into a change in potential sufficient to operate relays A and B. The upper photo tube controls one of the triodes to operate A while the lower tube controls the other triode to operate B. Relays A, B, and C perform as a group to control the operation of the motor as directed by the photo tubes. Relay D separates the pilot lamp current from the motor current but has no function in the control. If this relay were not used and the lamps were connected directly across the motor windings, the lamps would short circuit the motor capacitor and destroy the split phase which gives the motor its starting torque. The control has a range of 20 per cent of the applied load and the

sensitivity may be adjusted from $\pm \frac{1}{2}$ per cent to ± 2 per cent.

An Ignition Analyzer for Internal Combustion Engines

By H. C. Welch,
Chief Field Engineer
and J. V. McNulty,
Research Engineer
Scintilla Magneto Div.,
Bendix Aviation Corp.

THE Bendix-Scintilla method of detecting malfunctions in the ignition system of aircraft engines consists of observing changes in the primary voltage waveforms by means of a cathode ray tube. An impulse is taken from one spark plug and used to trigger the horizontal sweep circuit in the scope. This method affords perfect synchronization

and is capable of easy installation on any engine. The first pip on the left of the scope corresponds to the cylinder from whose spark plug the pick-up was taken and the remainder follow in the firing sequence of the engine.

The circuits controlling the cathode ray tube of the ignition analyzer are much the same as would be found in a standard oscilloscope. However, for this application, many of the stages for controlling various sweep frequencies have been eliminated. A unique circuit in the unit, not found in an oscilloscope, is a constant amplitude sweep which maintains a constant width pattern on the screen regardless of the engine speed. The unit is adaptable to operation from various power sources.

Synchronizing impulses for the horizontal time base are supplied by electromagnetic pickups. The primary consists of a section of high tension lead, while the secondary is composed of a number of turns of small wire. A Faraday shield or screen is placed between the primary and secondary so as to minimize the effects of capacitance. The magnetic pickups are employed in preference to capacitance types, because the amplitude of the cross signals encountered with the latter made it difficult to discriminate against undesired signals.

The method of producing the sawtooth waveforms for a linear time base consists in charging a capacitor through a resistance and subsequently, discharging it by means of a gaseous tube. If the discharge time is made small in comparison with the charging time, and if charging is limited to a small fraction of the supply voltage, the resulting waveform is essentially linear.

The sawtooth output is amplified and applied to the horizontal deflection plates of a C.R. tube. The remaining circuits serve to amplify the primary signals of the magneto being analyzed

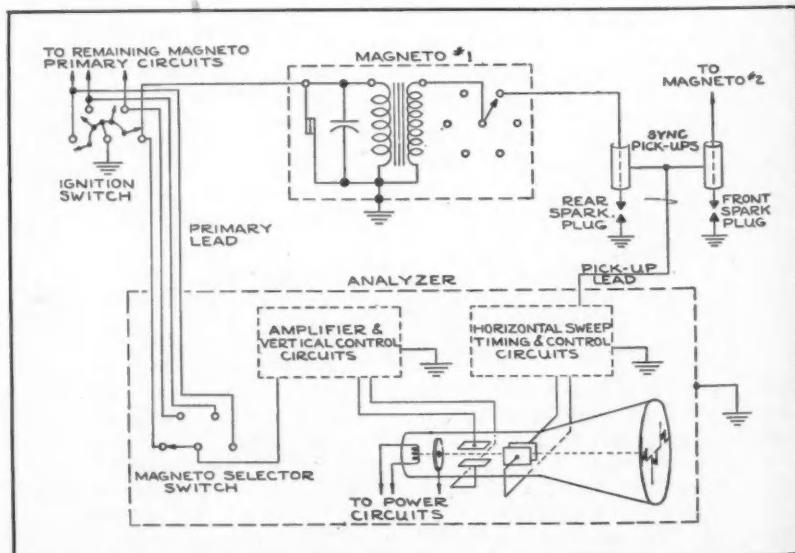


Fig. 4. Schematic diagram of ignition analyzer connected to high tension ignition system.

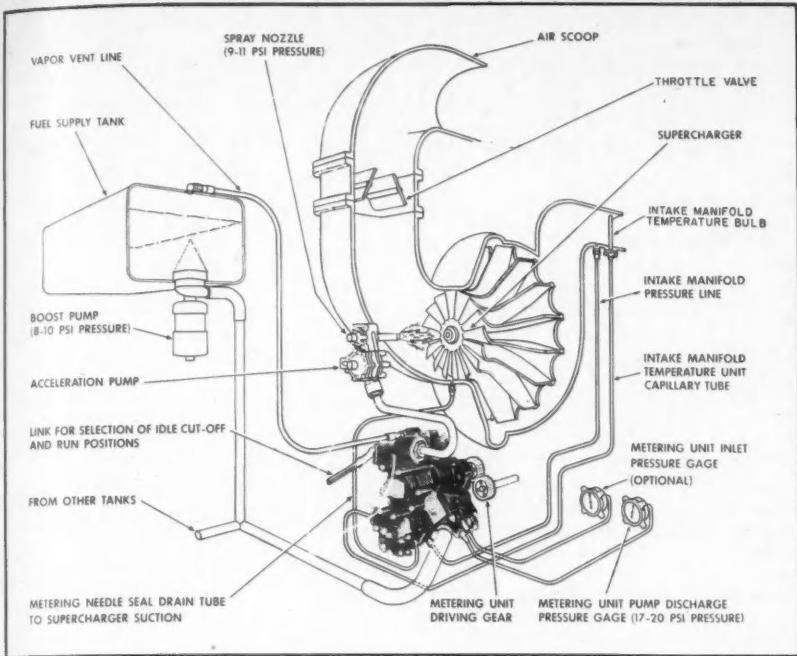


Fig. 5. Assembly sketch of Stromberg speed-density metering system.

and to apply them to the vertical deflection plates. The purpose of the magneto load resistor preceding the vertical amplifier is to permit loading of the magneto to the "just firing" condition of the spark plugs so that certain defects can be ascertained. Total weight of a flight installation for checking all engines of a four engine plane is 37 lb.

Fuel Metering by Engine Speed and Manifold Density

By Jay A. Bolt,
Staff Engineer,
Research & Development,
Bendix Products Div.,
Bendix Aviation Corp.

IN CONTRAST to other forms of metering equipment wherein the fuel is metered in response to variations in mass air flow through a venturi, the Stromberg SD-400 series speed-density metering unit meters the fuel in response to variations in engine rpm, intake manifold pressure, intake manifold temperature, and exhaust back pressure. The following are the principal elements:

1. An integral, vane-type, engine-driven fuel pump with a by-pass and relief valve, performing the function of the usual enginedriven fuel pump.

2. A centrifugal pressure regulator consisting of a set of centrifugal weights, a diaphragm subjected to the metering differential, and a valve. These component parts establish a fuel metering differential which is proportional to the square of the engine speed.

3. A pressure-responsive bellows assembly in a closed housing, operating a contoured fuel metering needle. The closed housing is vented to manifold pressure. The larger of the two bel-

lows is evacuated, while the smaller is internally vented to atmospheric or exhaust back pressure.

4. A temperature unit responding to changes in intake manifold temperature which consists of a temperature bulb, bellows, and flexible capillary tube filled with liquid, operating a contoured metering needle.

5. A centrifugal vapor venting system which utilizes the rotation of the centrifugal regulator assembly to effect the separation of air and vapor from the fuel. The air and vapor, with some liquid fuel, are drawn from the governor chamber at its centerline and conducted to a float chamber which vents the air and vapor from the unit and returns the liquid fuel to the inlet of the vane-type fuel pump.

6. A constant pressure fuel discharge nozzle for spraying the fuel into the air stream, or means for discharging the fuel from holes in the supercharger impeller. The latter is referred to as "spinner injection."

7. A throttle actuated accelerating pump and in some instances a water regulator, which may be incorporated in the adapter unit which houses the discharge nozzle.

8. An air throttle valve for controlling engine power.

The connections between the metering system and the engine installation are shown on the assembly sketch of Fig. 5. The vane type fuel pump is driven through a sear pin from the central driving shaft (not shown) which passes through the center of the pump to drive the centrifugal regulator. Fuel is supplied by the fuel pump to the governor chamber. The thrust of the rotating governor weights creates a force proportional to the square of the engine speed. This force is balanced against

the metering head diaphragm in such a manner that the poppet valve regulates the metering head to be proportional to the square of the engine speed, with some modification from an idle spring and a constant force from an unbalanced valve. Since fluid flow is proportional to the square root of the head, the flow through any fixed jet area will then be approximately proportional to the engine speed.

The manifold pressure and exhaust back pressure bellows assembly moves a contoured needle which establishes the metering jet area for each combination of intake manifold pressure and exhaust back pressure. The temperature metering assembly includes a second contoured needle and fuel orifice in parallel with the pressure responsive orifice. The area, and fuel flow, of the temperature unit orifice are made proportional to the engine intake manifold temperature. By proper contour of the temperature metering needle the change in fuel flow per unit of temperature change is made to correspond to the change in air flow of the engine at some cruise power. At this manifold pressure the compensation for manifold temperature will be exact.

Idle mixture is adjusted by an idle spring which changes the idle fuel flow by adjusting the metering head.

Minute Amounts of Cylinder Wear Are Measured with a Microscope

By Clarence S. Bruce,
and Jesse T. Duck,
National Bureau of Standards

THE National Bureau of Standards recently has completed a series of tests in which the cylinder wear of automobile engines during short operating periods has been determined by means of an optical instrument. The wear is determined by observing changes in length of indentations made on the cylinder wall with a precisely shaped diamond indenting tool. The length of the indentation is measured accurately using the specially constructed microscope, and its depth is computed from the length measured. The amount of wear at any given point is computed as the difference in the computed depths of an indentation before and after a period of operation. It is estimated that wear observations made with this apparatus are precise to 0.00002 in., and amounts smaller than this can be detected.

The apparatus consists of three essential parts: a precisely shaped diamond indenting tool, an indentation locator, and a microscope. The diamond indenter can be adjusted to make marks from 0.5 to 2 mm in length. In practice a mark about one mm long has been found convenient. When the indentations are made in the cylinder wall the indenter is held securely in place by the indentation locator. The core of the locator can be rotated within its base so that marks can be made at definite intervals around the cylin-

der wall, and provision is made to lower the indenter by 0.25 in. increments from 0.5 in. to several in. from the top of the cylinder. The microscope fits into the locator in exactly the same way as the indenter, so that when the locator is in the indenting position the indentation is in the field of view. The optical system of the microscope is so designed that the image of the indentation is in focus at a definite distance. A graduated scale is superimposed on the image of the indentation so that the length of the indentation is read directly in scale divisions. The scale is uniformly graduated into 100 divisions, each of which corresponds to 0.01 mm. Errors of the microscope scale do not exceed 0.2 per cent. Since the depth of the indentation is a function of its length, the depth may be computed from the length measured on the optical scale. The amount of cylinder wear during any period of operation may be represented approximately by the difference in the computed depths of the indentation before and after the operating period.

An Instrument for Piston Temperature Measurement

By A. C. Scholp,
G. R. Furman,
and P. A. Binda,
The Texas Co.

THIS paper presents methods and designs of a piston thermocouple contactor for obtaining measurements of piston temperatures in laboratory testing of internal combustion engines. The assembly incorporates three basic elements: thermocouple, contact elements, and contactor. The thermocouple consists of two flat, inclined surfaces or shoes, made of high-carbon steel hardened to approximately 300 Diamond Brinell. The holder for these shoes is adapted to a standard cast iron piston, and comprises an extension to the piston skirt to bring the contact element surfaces below the end of the cylinder liner at bottom dead center. This holder is attached to a circular mounting bracket screwed to the bottom piston skirt reinforcing rib.

The contactor unit consists of a smooth fitting air-tight plunger and barrel assembly installed in a mild steel block. The contact elements are installed by screwing into the plunger noses, and are replaceable to prevent excessive wear of the non-interchangeable plungers. They are made of the same unhardened high-carbon steel as the shoes to prevent emf from being generated between the two parts.

The contactor unit and shoe holder are installed in the crankcase and on the piston, respectively, so that contact between plunger tips and shoes is made for a portion of the stroke when the piston is near bottom dead center. Connections are made from the contactor unit to both air pressure and vacuum lines through a solenoid actuated, three-way valve. In this way,

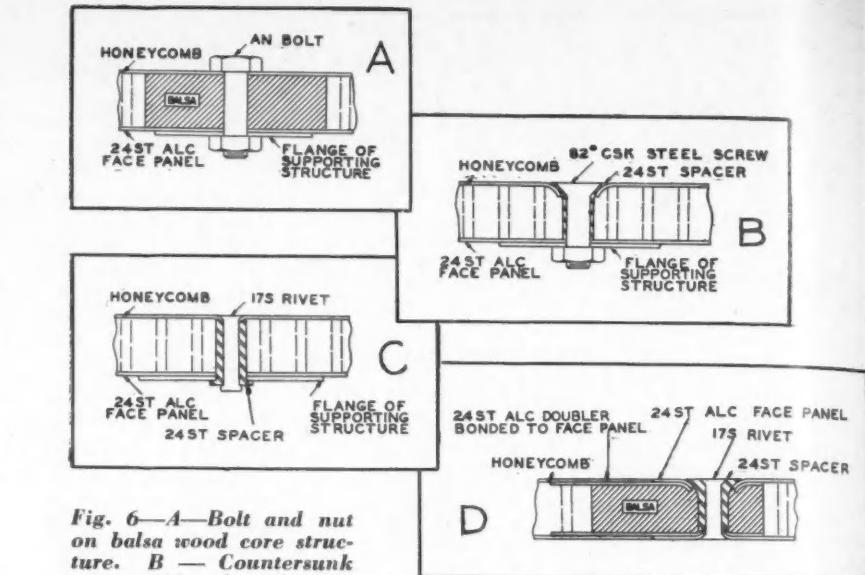


Fig. 6—*A*—Bolt and nut on balsa wood core structure. *B*—Countersunk screw with a aluminum spacer on honeycomb core structure. *C*—Rivet and spacer combination on honeycomb core structure. *D*—Typical butt splice with doubler bonded to face panel.

when readings are desired, the solenoid is actuated to move the valve to introduce air behind the plunger. On release of the solenoid, the valve returns to its normal position so that vacuum retracts the plunger to a non-contacting position. Since this unit is utilized in a remote position, assurance is obtained that contact occurs no longer than is necessary to obtain readings.

A multi-point thermocouple contactor was also developed which utilizes the identical principle of the single point contactor except that one of the two contact points is movable and located below, instead of beside, the second contactor. Instead of the two adjacent shoes, a single shoe is utilized for all iron thermocouple leads, whereas the constantan leads are connected to seven shoes placed in a line below the top shoe. In this manner, by moving the lower contactor, it can be brought successively into contact with the seven shoes provided, each contact bringing into the potentiometer circuit the thermocouple attached to that shoe. This design was utilized in a cast iron piston similar to that on which tests on the single point contactor assembly were made. Test results with both instruments were satisfactory.

Philosophy for Design of Sandwich Type Structure

By John F. Korsberg,
Boeing Aircraft Co.

THE major problem in sandwich-type structural design is the development of practical fitting details which will give adequate static and fatigue

strength while preserving reasonably practical and economical shop fabrication procedures. Fig. 6 illustrates some of the fittings which have been found useful to the honeycomb core as well as the balsa core sandwich paneling. Each fitting has its particular characteristics, and only by analysis of the design conditions to be met can the proper fitting be selected. Use of a countersunk screw without a space in the honeycomb core panels has been unsatisfactory because in all cases a supplementary fitting is required to react the local compressive loads attendant to drawing the screw flush with the panels face. When riveting, both types of paneling require radial restraint for the rivet shank to prevent local buckling and permit formation of a full driven head.

Aircraft Detonation Indicators

By J. S. Bogen,
and W. J. Faust,
Universal Oil Products Co.

THIS paper presents a summary of the developments and applications of detonation indicators for full-scale and laboratory aircraft-engine testing.

For detecting detonation in the Allison aircraft engine, the Allison Division of the General Motors Corp. has developed instruments which may be used for single-cylinder test work, multi-cylinder bench testing, experimental flight testing, and routine flight operation. For each application a pickup is employed which operates on the magnetostriction principle and has no moving parts. Fig. 7 is a schematic illustration of the construction of a typical magnetostriction vibration pickup which consists of a permanent magnet surrounded by a coil and assembled under stress in a two-piece body. Engine vibrations cause accelerational forces to be exerted on the permanent magnet. The changes in stress due to these forces

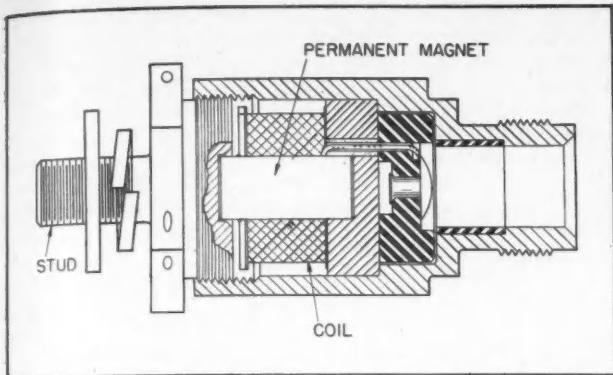


Fig. 7 — Cross section view showing the construction of a typical magnetostriction vibration pickup.

produce flux changes which induce an alternating voltage in the coil (Fig. 8).

The Brown Instrument Co., requested to develop a detonation indicator based on the ionization characteristics of a burning charge of fuel, found that current flow between two electrodes placed in the combustion chamber of an engine followed the general pattern shown in Fig. 9 with detonation imposing a high-frequency component on the comparatively smooth ionization curve of normal combustion. The initial rise of the curve is very steep and actually contains many frequencies, making detonation detection rather difficult. Further research showed the present impracticability of using ionization as a means

Fig. 8—Diagram showing operation of detonation indicator developed by the Allison Div., General Motors Corp., for detecting detonation in the Allison aircraft engine.

so that its diaphragm was directly responsive to the combustion pressure. A rotary step switch consecutively connected each pickup to the meter circuit for intervals of one second. In order to eliminate the interference caused by valve noise, an electronic switch was incorporated in the circuit. For laboratory use, the Phillips Petroleum Company has developed a meter which eliminates the electronic commutator used in their flight test instrument.

The Sperry Gyroscope Company manufactures detonation indicating

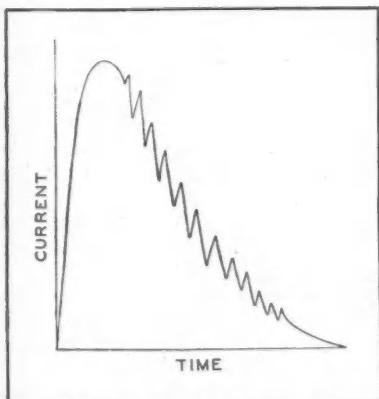
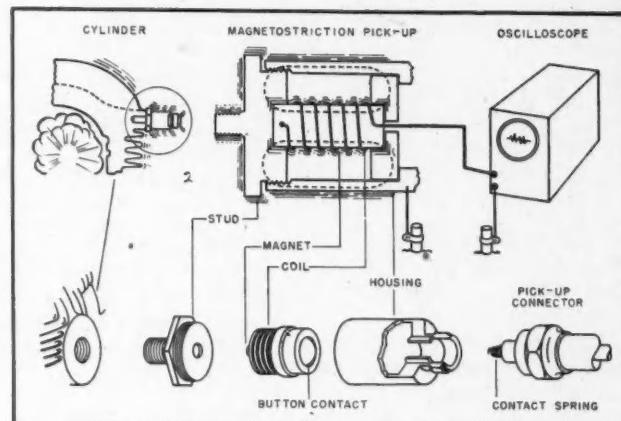


Fig. 9—Pattern of ionization current flow during detonation combustion in an engine. Detonation is indicated by the high-frequency components to the right. With normal combustion, this curve is smooth.



use with a cathode-ray oscilloscope, and as such is limited to experimental testing.

The Phillips Petroleum Company has used an instrument of their own design for indicating detonation during flight tests. A Lane-Wells magnetostrictive pickup was mounted on each cylinder

equipment for determination of fuel requirements of a particular engine, for experimental engine and fuel testing, and for routine flight instrumentation. All forms of this equipment use similar components. The basic system of detection involved is a measurement of the increase in vibrations of the engine

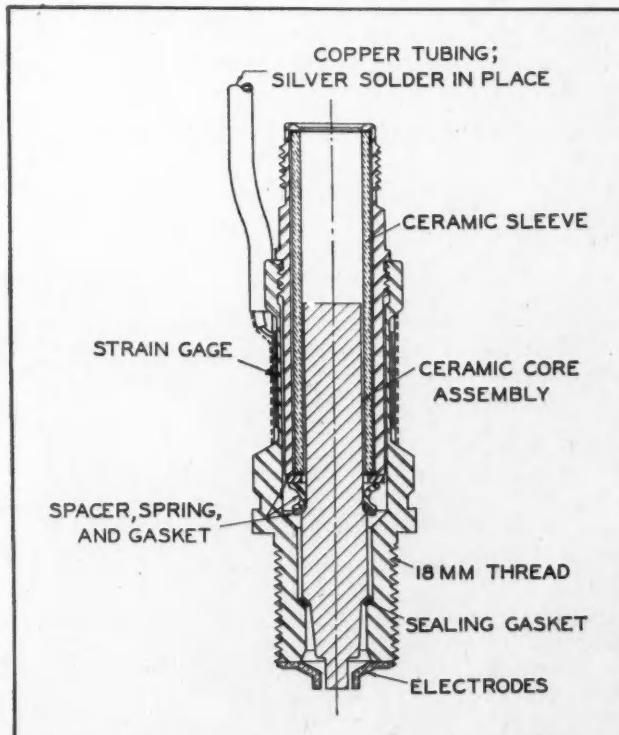


Fig. 10—This detonation pickup, developed by the NACA, is essentially a modification of the standard ceramic-type aircraft spark plug.

of indicating detonation. If further fundamental studies are made, a practicable scheme may be evolved.

The National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, has developed a detonation pickup which requires no special mounting facility. As shown in Fig. 10, the pickup is essentially a modification of the standard ceramic-type aircraft spark plug and is used with a conventional high-gain amplifier. This amplifier was designed for

cylinder when detonation occurs, using a pickup which operates on the magnetostrictive principle. Three different types of amplifiers are used: the "Knockometer" amplifier for fuel testing; the adjustable gain amplifier for experimental engine and fuel testing; and the 28-v automatic gain control amplifier for flight operation.

The Standard Oil Company of California has developed detonation indicating equipment which is based on two magnetostrictive devices—the internal type and the external type of Calstan detonation pickup. Either oscilloscopes or meter circuits are used to indicate the pickup output. For increased utility, commercial oscilloscopes are modified for use with the internal pickup. For flight testing, a two-inch portable oscilloscope was developed. This unit contains all the features incorporated in the modified commercial 5-inch oscilloscopes. For the sake of portability, size and weight were reduced to a minimum. For laboratory use, the Standard Oil Company of California developed three instruments to indicate detonation intensity for use with their magnetostrictive pickups.

The Electro Products Laboratories have developed two separate types of meters which may be used for the indication of detonation level in research laboratory studies of aircraft engines and fuels. These meters employ an electro-magnetic rate-of-change-of-pressure type of pickup.

The Development of Detonation Instrumentation for Automotive Vehicles

By J. H. Goffe,
and J. W. Wheeler,
Engineering Div.,
Sperry Gyroscope Co., Inc.

THE KM-4 Knockmeter, developed by Sperry for automotive fuel studies, will indicate engine knock by the flashing of a neon light. The light will flash once for each knock with an intensity reasonably proportional to the

knock severity. As the knock phenomena in the internal combustion engine is basically erratic, the engine knock signal is integrated against time in order to obtain a more stable reading, thereby obtaining a scalar representation of knock intensity. In automotive engine application, the needle rises rapidly at the first pulse of detonation; afterwards the integrating circuit establishes an average or integrating value. The Knockmeter circuit includes voltage regulation and automatic volume control.

Installation time excluding an auxiliary tachometer drive adaptor usually is less than one hour. For short tests the instrument may be placed on the seat of the automobile. It has been used on engine dynamometer, chassis dynamometer, and road tests; and has been used with the Borderline, Modified Uniontown, and Standard Uniontown methods of rating in automobiles. Good reproducibility has been obtained in all testing on this instrument to date.

Developed as auxiliary equipment for the KM-4 Knockmeter is a cathode ray tube instrument which provides visual checks of engine vibration patterns. Called a Polar Coordinate Oscilloscope, the device provides a method of obtaining exact synchronism of sweep speed with engine speed which is advantageous in finding the crank angle of the engine when any particular event occurred. The cathode ray oscilloscope is provided with the usual X and Y position, beam intensity, and focus controls. Automatic volume control circuits are employed to maintain a constant circle diameter regardless of engine speed or two-phase generator voltage output. A signal gain control is also supplied to facilitate pattern studies. Another auxiliary development for the KM-4 is a method of recording knock phenomena. Since the usual frequency of detonation is in the neighborhood of 8,000 to 10,000 cycles per second, a commercially available two channel paper and ink recorder is employed and the knock signal is modified in such a way as to

bring the resultant record within the frequency range of such a recorder i.e. (from 4 to 100 cycles per second).

The complete KM-4 Knockmeter equipment will: detect and measure knock level, rating fuel similar to the ear of a skilled operator; detect which cylinder or cylinders are knocking; record the knock level against traces from which speed may be measured; and assist in analysis of abnormal engine vibration conditions due to valves or other sources. It is convenient to use, and may be used with any existing test method, and on road, chassis dynamometer, or engine dynamometer installations.

Experiences of an Aircraft Manufacturer with Sandwich Material

By H. B. Gibbons,
Chief of Structures,
United Aircraft Corp.,
Chance Vought Aircraft Div.

THE manufacture of the sandwich material, Metalite, involves a series of processes, each of which is relatively simple. The sheet metal parts are first cut to shape by blanking or routing, then thoroughly cleaned, masked for spraying, and sprayed with Cycleweld adhesive, which is then cured in an oven at 325°F for one-half hr. The balsa planks are trimmed to size and bonded with a room-temperature-setting glue into bolts about two ft by four ft in cross-section. Slices from these bolts are cut on a band saw to produce the end-grain core material. To form the required size panel, the slices are further edge-glued together and trimmed. The panel is sanded to the desired thickness on a drum-sander, routed where necessary for internal doublers and splicing strips, and then completely sprayed with the sizing agent. The Cycleweld-coated areas of the metal parts are spread with the secondary adhesive and assembled with the wood core on a mold of the required contour. Then the assembly is covered with a light rubber blanket, which is sealed to the mold, and curved in an autoclave under the proper temperature and pressure conditions.

For any large-size structure, such as a wing or fuselage, the structure is designed and fabricated as a number of separate components, the components being joined together by rivets or bolts. The XF5U-1 airplane structure is a good example of this procedure. In laying out any design it is necessary to obtain a reasonable balance among the limitations imposed by joint loads, sheet sizes, mold and autoclave sizes, and assembly procedures to arrive at an efficient and practical design.

Basically, the factors affecting the arrangement of the primary internal structure are the same for sandwich structures as for conventional metal structures. The major differences lie in the spacing needed for secondary items, such as ribs and frames, and

(Turn to page 80, please)

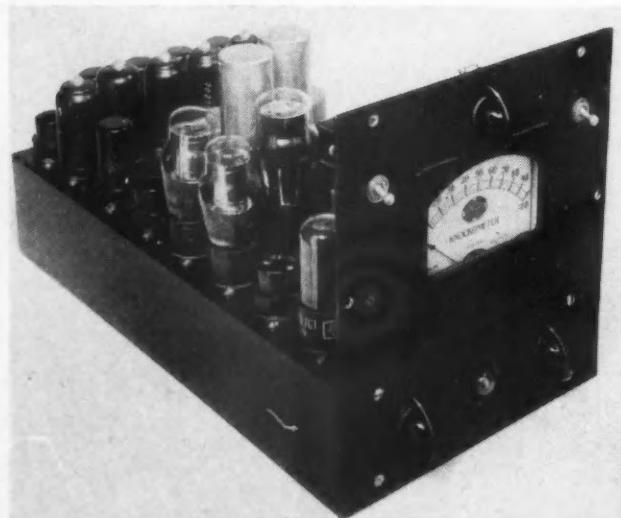


Fig. 11 — This Knockmeter, the KM-4 model developed by the Sperry Gyroscope Co., indicates automobile engine knock by a neon light and a graduated dial.

Electronic Ignition

System in Experimental Stage

By Alfred J. Poole

Joint Intelligence Objectives Agency
Office of Military Government for Germany (U. S.)

AN ELECTRONIC ignition system, produced experimentally by the Bosch firm in Reichenbach, Germany, during the latter part of the war, is claimed by the Germans to eliminate many of the deficiencies of a conventional magneto system. Basically the circuit involves a condenser, serving as an accumulator, charged through a resistance and discharged through a grid-controlled tube to the primary of the high-tension coil at the spark plug, as shown in Fig. 1. After completion of the discharge, the grid voltage prevents further passage of current between the anode and cathode of the tube, and the condenser charge is again built up. Special gas filled tubes are used in the system.

Fig. 2 shows the ignition system which is controlled by means of a light beam and disk having slots located to conform to the desired ignition timing and through which the light beam passes. This disk is driven at camshaft or crankshaft speed depending on the type of engine involved. The light reaction on the photo-cell drops the grid voltage and permits a discharge of 10 amp at 400 v from the condenser across the anode and cathode of the tube. The light

impulses are transformed into current impulses and amplified by means of the gas filled tube. This current is distributed to the individual coils. A transformer steps up the 24 v battery current to the 400 v required for the tube operation. Using a condenser of 2 uf, a resistance of 1000 ohm and an operating voltage of 400 v, a delivery of 30,000 sparks per min of good heat characteristics is claimed, even with relatively small transformer coils.

The main advantage claimed with this ignition system for aircraft application are: 1. Accuracy in timing of spark; 2. Ability of timing spark in regular angles as required in the radial type of engine; 3. Maintenance of accurate timing as no wearing parts

(Turn to page 90, please)

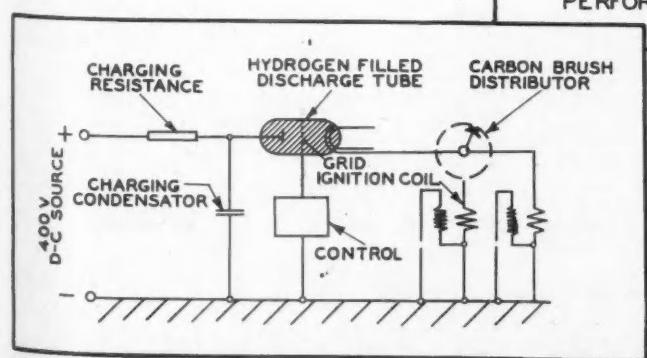
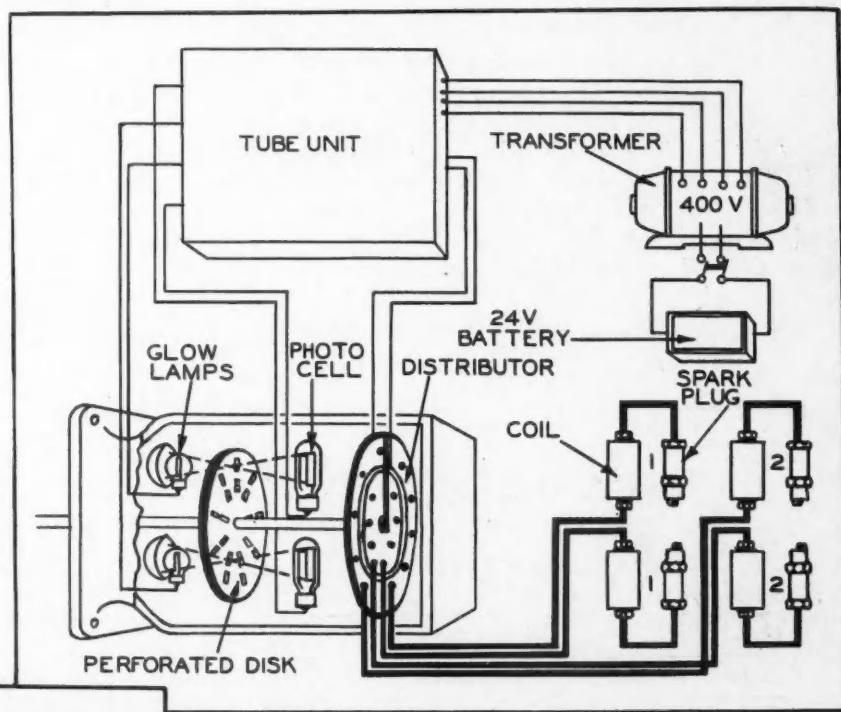


Fig. 2. (Above) Photo-cell and light beam arrangement for controlling electronic ignition system.

Fig. 1. (Left) Diagram showing basic parts of electronic ignition system.

A

NEW line of four Diesel engines has been announced by the Waukesha Motor Co.—one four-cylinder model (180-DLB) of 134 cu in. displacement, and three six-cylinder models (190-DLB, 148-DLB, 6-WAKD) of 247, 779, and 1197 cu in. displacement, respectively. Interesting feature of the two smaller models (180-DLB and 190-DLB) is the fuel system which incorporates a flange-mounted single-plunger fuel-injection pump newly developed by the American Bosch Corp. Specifications of these new Diesel powerplants are given in the accompanying table. These details are subject to change, however, as the engines go through production.

Main mechanical features of the 180-DLB and 190-DLB engines are quite similar. Cylinder heads are single piece alloy iron castings with overhead valves, rocker arms, and combustion chambers. Crankcase and cylinder frame are of alloy iron heavily ribbed and braced by cross walls and water circulating baffles. Wet sleeve liners of Waukesha alloy hardened to 350-400 Brinell are standard. Four-ring pistons are used: cast iron for industrial service; aluminum alloy for automotive duty. Piston ring set-up consists of three 0.125 in. compression rings and one 0.25 in. oil control ring, all above the piston pin. The top compression ring is chrome plated in both models. Crankshafts are hardened steel forgings, heat treated, with extra heavy checks. The 180-DLB has a three-bearing shaft while the 190-DLB has a four-bearing shaft. Main and connecting rod bearings are of precision type, steel-backed, copper-lead-babbitt alloy designed for heavy duty diesel service. Connecting rods are heat

treated drop forgings with bearings held by deep-ribbed forged caps and two heat-treated bolts. Intake and exhaust valves are of chrome-silicon alloy with a hardened alloy insert for the exhaust valve only. Removable valve guides are used.

Lubrication is by a pressure and spray system with oil delivered under pressure to main bearings. Metered spray lubricates timing gears, connecting rod bearings and overhead valve mechanism. Crankcase mist lubricates cylinders and pistons. The injection pump governor is of centrifugal type, self-lubricated and non-hunting. Starter is of 12-v type with manual shift and over-running clutch.

180-DLB and 190DLB Engines Equipped with Single-Plunger Fuel-Injection Pump Newly-Developed by American Bosch

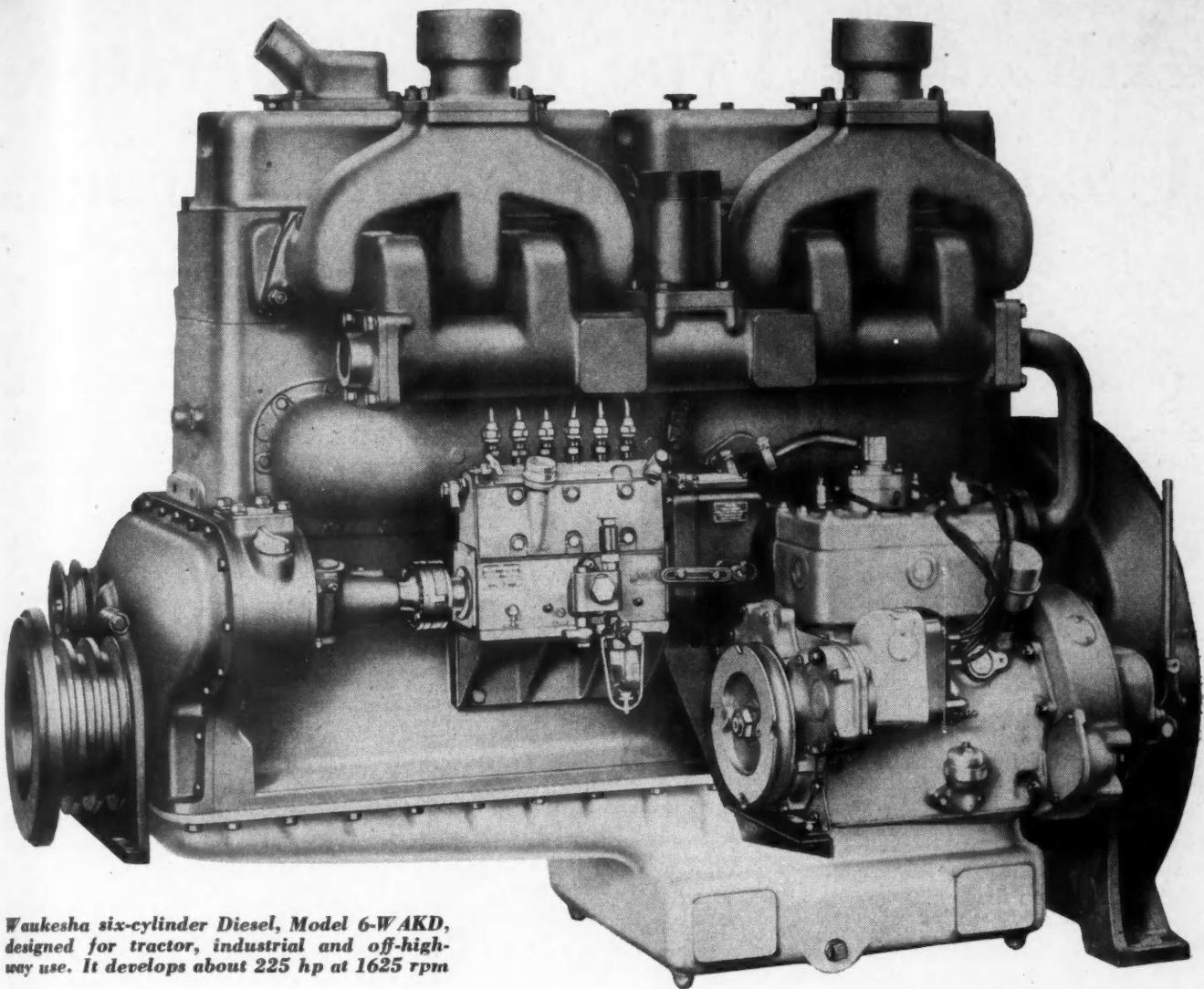
The basic features of the 148-DK and 6-WAKD engines are quite similar: both have twin cylinder heads, interchangeable both front and rear, and carry the valves and valve gear. The exhaust and intake valve inserts are of hardened alloy. The combined crankcase and cylinder block frame is deep and rigid with extra heavy upper and lower decks to form the seat for the removable wet type sleeves. Pistons are of heavy duty aluminum alloy with six rings: four of non-sticking wedge type, and two straight-sided oil control rings. The two compres-

Waukesha Adds Four

Waukesha Diesel Engines

Model	180-DLB	190-DLB	148-DK	6-WAKD
Cylinders	Four	Six	Six	Six
Bore	3.375 in.	3.625 in.	5.25 in.	6.25 in.
Stroke	3.75 in.	4.0 in.	6.0 in.	6.50 in.
Displacement	134 cu in.	247 cu in.	779 cu in.	1197 cu in.
Output*	Industrial Rating 28 hp at 1800 rpm 84 lb-ft at 1300 rpm	80 hp at 3000 rpm 168 lb-ft	162 hp at 1800 rpm 525 lb-ft at 900 rpm	225 hp at 1625 rpm 850 lb-ft at 950 rpm
Application	Tractor, Industrial	Automotive, Tractor, Industrial	Automotive, Tractor, Industrial	Tractor, Industrial, Off-highway

* Horsepower and torque values given here are based upon field and laboratory data and are subject to change.



**Waukesha six-cylinder Diesel, Model 6-WAKD,
designed for tractor, industrial and off-highway use. It develops about 225 hp at 1625 rpm**

New Diesel Models

sion rings and two scraper rings are 0.15625 in., while the two oil control rings are 0.25 in. face. The top compression ring is chrome plated. The seven-bearing crankshafts are heat-treated and hardened drop forgings, accurately balanced. Crankpins and main bearing journals are 600 Brinell. Massive cheeks give maximum stiffness while a front-end-mounted torsional vibration dampener adds to smoothness of operation. Main and connecting rod bearings are of precision type, steel-backed, with copper-lead-babbitt alloy lining. Bearings are held in the upper half crankcase by heavy ribbed caps and heat treated bolts. Connecting rods are of heat treated, drop forged steel, of I-beam section and have deeply ribbed caps held by four heat treated bolts. The small end bearing is of hard bronze. Piston pins are full-floating of extra large diameter, hollow, with hardened and lapped finish.

Full pressure lubrication to all rocker arms and

bearings is provided by an outside-mounted positive gear type pump while the pistons and cylinder walls are lubricated by the oil mist. A large capacity oil cooler with automatic by-pass and adjustable pressure regulator is mounted on the cylinder block, the regulator being connected in series with the circulating system. A large capacity, waste packed, continuous oil filter is shunt connected to this system. Cooling is by means of a large-capacity double-impeller water pump, gear-driven and flange-mounted on the timing gear case. Twin thermostats are provided in the water outlet housing. Fuel injection system incorporates a multiple plunger Bosch pump and is protected by a waste type fuel oil filter. The injection pump governor is mounted on the injection pump, is fully enclosed, self-lubricating, and non-hunting. Starting is by either a 24-v electric system with glow plugs or a gasoline starting engine. Details of combustion chamber design will be described at a later date.

Advanced Type of Temperature Control for Buses and Trucks

GMC-Surface Combustion Engineers Develop System That Automatically Regulates Interior Heating, Ventilation, and Water Jacket Temperatures

AN advanced heating and ventilation system for transit-type buses, introduced by the GMC Truck & Coach Division, General Motors Corp., serves the dual purpose of supplying thermostatically controlled fresh air to a bus interior as well as maintaining the engine-jacket temperature of the vehicle at the desired operating level.

The system consists of two independent units—the Thermo-Matic ventilating unit which supplies up to 1000 cfm of fresh air to the bus interior; and the booster heater, an independent heating unit located under the bus floor. Functions of the booster heater are quite unique in automotive practice. It is connected to the water jacket circuit of the engine and thermostatically controlled to provide additional heat to the engine under operating conditions, particular at low ambient temperatures, and during the warm-up period, or when the vehicle is parked and the engine off or idling. The heater also provides abundant hot water for passenger space heating. Operation of the system is shown in the illustration on this page.

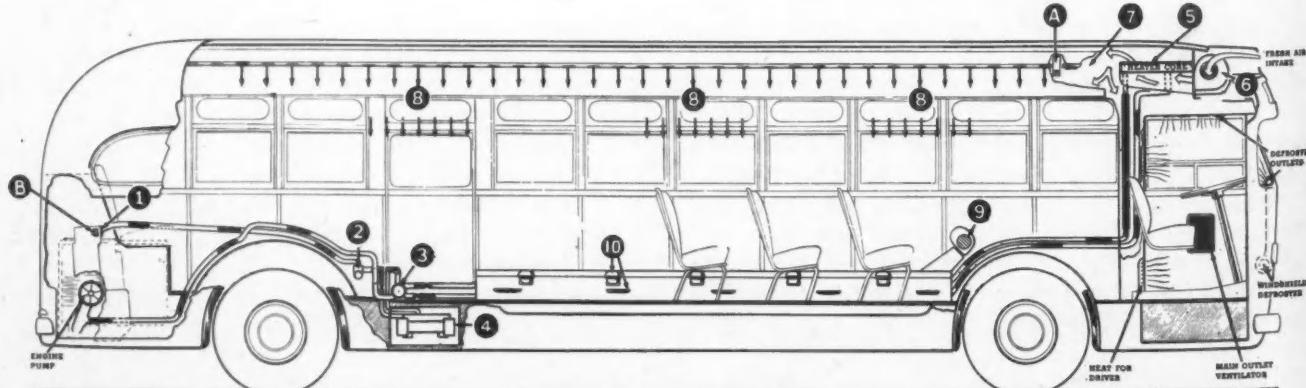
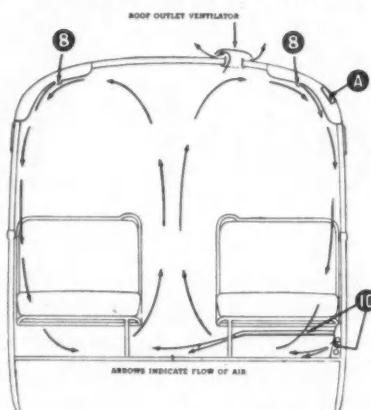
Maintenance of jacket temperature is of special importance in engine operation. In the case of either Diesel or gasoline en-

gines, the heater eliminates all cold weather operating hazards, makes for quick starting, and makes anti-freeze mixtures unnecessary. The heater, developed as a joint cooperative venture of GMC engineers and the Surface Combustion Co., is of liquid-fuel burner type and may be arranged to burn either fuel oil or gasoline, thus making it applicable to either type of powerplant.

Apart from passenger comfort through use of the Thermo-Matic system, the installation of the booster heater alone is expected to provide some unusual advantages. GMC engineers already have accumulated data to prove that the maintenance of high jacket temperatures will prevent crankcase dilution, sludging, and eliminate the industry's problem of low-temperature corrosion of cylinder barrels. Although this heating and ventilating system was designed primarily for bus installation, its adaptability is obvious for comfort heating of motor truck cabs, for preserving perishable cargo in truck and trailer trains in sub-zero weather, and eventually as an answer to the problem of providing comfort and better visibility in passenger cars. For truck and trailer installations,

(Turn to page 90, please)

Shown here is a diagrammatic sketch of the GMC automatically-controlled temperature system. Engine - jacket water 1 is circulated through the heating system by the engine pump and an electrically driven booster pump 2 which insures positive circulation during idling or engine "off" periods. A diversion valve 3 controls water flow to the heater core or diverts it back to the engine as controlled by thermostat A. The booster heater 4 supplies additional heat to the system for low temperature operation and is controlled by aquastat B. The main heater core 5 receives fresh air from motor-driven blower 6 and ducts 7 distribute air to both sides of the coach through slots 8. Blower 9 circulates heat to the floor on both sides through slots and tubes 10.



NEW Production and Plant EQUIPMENT

A N IMPROVED LINE of standard motor-driven flash welders has been announced by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich. These machines have been designed for precision flash welding virtually any metal, including aluminum, for long periods at high production.

They combine both "universal" and "specially engineered" features, making possible a wide range of applications without major alterations in the basic machines. Machines may be operated either alternating current through transformers, or direct current through the use of storage batteries. All units are enclosed within the machine frame. Flat tops on most of the machine types also help make these welders more universal in their applications. Entire machine control is from only one position.

The improved Progressive motor driven flash welders are available in four capacities from 20 kva to 150 kva, or they may be battery operated for any welding job that is within the physical capacity of the machine. Upset pressures are 2250 lb, 4500 lb, 11,500 lb, and 19,600 lb for the four machine sizes; maximum stock width, vertical fixture is 2 in., 4 in., 6 in., and 8 in.; and maximum tube OD, vertical fixture, is 1 in., 1 1/4 in., 1 1/2 in., and 2 1/4 in.

Standard equipment furnished with all types of flash welders includes clamping fixture with one set of plain dies with hand or foot valve as desired, Cone-Drive speed reducer, and upset mechanism with heat switch for

energizing contactor for current on and off time. Such standard extras as air clutches, air pressure regulator and gauge assemblies, and series-parallel regulators are available.

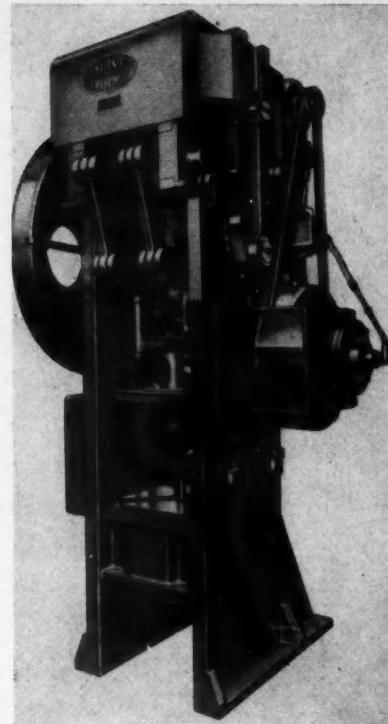
THE E. W. BLISS CO., Detroit, Mich., has developed a new line of single-crank toggle presses in eight sizes ranging from 4 1/4 in. to 1 in. shaft diameter and from 8 1/2 in. to 24 1/2 in. stroke length. They are used for deep drawing operations on steel, brass, copper, aluminum and other metals.

The new designs feature steel-weldment construction, resulting in weight-savings and reduced floor space requirements. Operating speeds, stroke lengths and die-space dimensions remain the same as those for previous models, thereby permitting interchange of tools.

Assembling and servicing are facilitated by the new design and construction principles, according to Bliss engineers. The amount of bearing overhang has been greatly reduced. Redesign of the toggle driving mechanism provides a cross head with long guides at the position where it is most needed. Steel rockshafts, yokes and links are provided in the toggle-driven blankholder mechanism.

The clutch is of the new Bliss single-disc friction type, with one-station electric pushbutton control. An air brake for stopping the flywheel is included.

The frame is a one-piece weldment of stress-relieved steel. Single drive crankshaft and single end blankholder



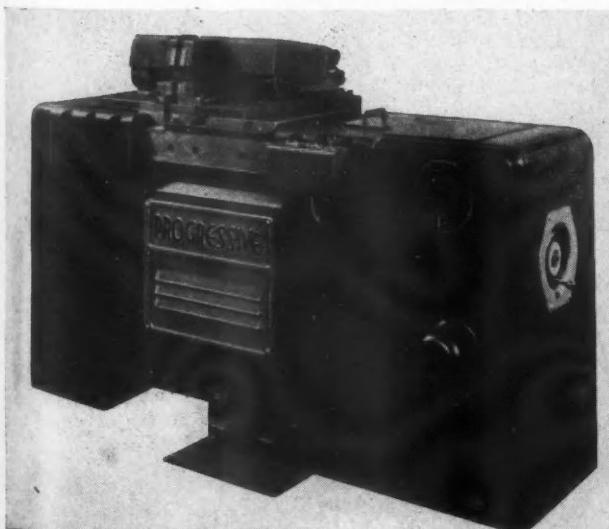
One of the new line of Bliss single-crank drawing presses

drive are employed. The presses also feature as standard equipment radially T-slotted bolster plates, and direct-connected adjustable bottom lifts out to leave the space between the uprights free and clear.

All of the new machines have steel gearing, fully guarded to approximately eight ft above floor level. Single helical or herringbone gears can be furnished as an extra feature.

A Bliss manifold lubrication system, with metal tubing leading to each bearing, is standard equipment, replaceable by semi-automatic or automatic lubricators of the user's choice.

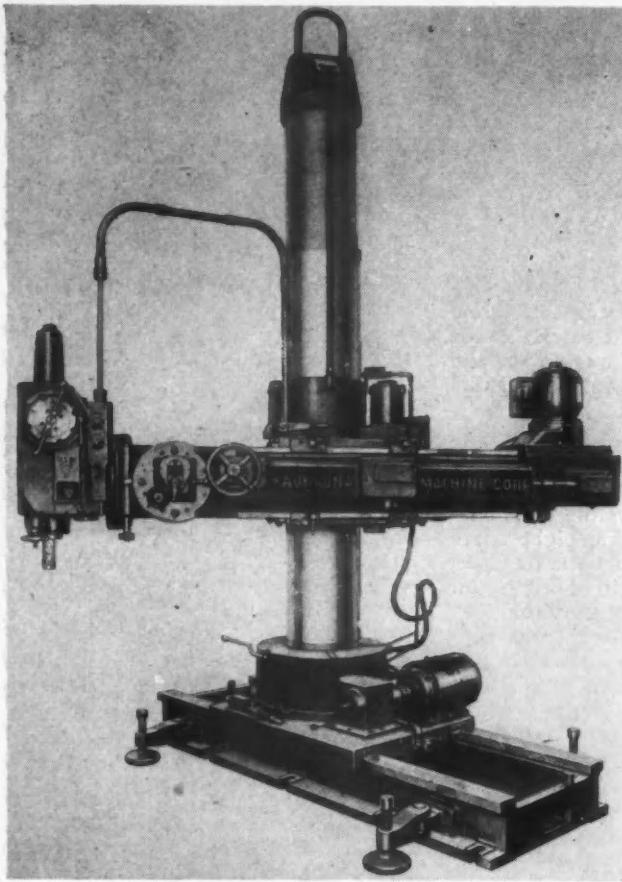
Drive shaft and flywheel are roller-bearing equipped. Crankshaft, rockshaft, intermediate shaft and link-pin bearings are bronze-bushed.



Progressive motor-driven flash welder

ALL the combined operations of the conventional radial and horizontal drilling and tapping machines are now available in the Kaukauna series 125 portable universal horizontal drilling and tapping machines, designed and built by the Kaukauna Machine Corp., Kaukauna, Wis. These units can drill and tap at any angle in any plane within the maximum and minimum limits of travel or movement of the machine units.

An important feature of Kaukauna portable universal drilling and tapping machines is the head which swivels 360 deg in either a horizontal or vertical plane. Thus, it is possible to operate the spindle, which has a 12-in. continuous travel, in any angle. The headstock is positioned on two individually controlled axes to permit the head to

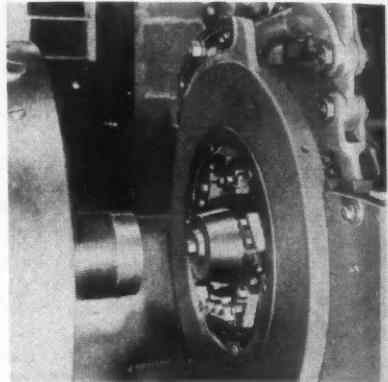


*Kaukauna drilling
and tapping
machine*

verse; water pump in the cooling system; mechanical governor for closer control of speeds and better carburetion; and a flattened nose to provide surface for pushing loads.

LANDIS MACHINE CO., Waynesboro, Pa., has designed a centering pilot for the Landis 8½ in. and 13½ in. receding chaser pipe threading and cutting-off machines.

The spring pilot is bolted onto the



Landis centering pilot

rear of the cross rail. Since this necessitates the removal of the cutting off slides, the machine is limited to threading only when equipped with the spring pilot.

Since the spring pilot forms a center in the bore of the die head for centering the pipe with the die head, only the rear chuck of the machine is used to grip the pipe during the threading operation. It is necessary that the front chuck clear the pipe by approximately $\frac{1}{8}$ in. to permit the pilot to fully engage the bore of the pipe.

In operation, the pilot is forced forward by a spring and engages the bore of the pipe prior to the pipe advancing to the chasers. The spring forces at

swivel 360 deg on a trunnion, and the two trunnion to swivel 180 deg. The two rails, supporting the head and trunnion, have a 24-in. horizontal traverse, and their movement is accomplished through dual handwheels with dual hand-clamps locking the rails into position. In addition, the rail may be raised or lowered by power and be positioned at any point that is suitable to perform the machining operations. The rail may also be swiveled through 360 deg to perform machining operations at any point around the machine.

Work is held on a Kaukauna Model 700 indexing table which permits the work to be quickly rotated to present five surfaces to the machine.

A total of 36 in. spindle movement radially from the center of the column is available, since the head is mounted on two horizontal rails which have a 24-in. horizontal adjustment and the spindle has a 12-in. continuous travel.

To facilitate handling machining operations on long workpieces, the column is supported on a traveling column base which has 48-in. power travel.

Kaukauna offers three models in the series 125 portable horizontal drilling and tapping machines—Models 125-U, 125-HR, and 125-H. The Model 125-U universal unit is a completely universal machine and will drill and tap holes at any conceivable angle. The No. 125-HR and 125-H machines are horizontal machines. The HR machine has the head mounted on two horizontal rails, having a 24-in. horizontal adjustment.

CLARK TRUCTRACTOR, Division of Clark Equipment Co., Battle Creek, Mich., is making an improved Clarkat towing tractor. Among the improvements listed are a wider steering axle, either pneumatic or solid tires front and rear; forged steel spindles; center pivoted suspension of steering axle and center control type steering gear operating through worm and gear sector; greater accessibility to motor and drive units; standard automotive type transmission with three speeds forward and one re-

*Clarkat towing
tractor*

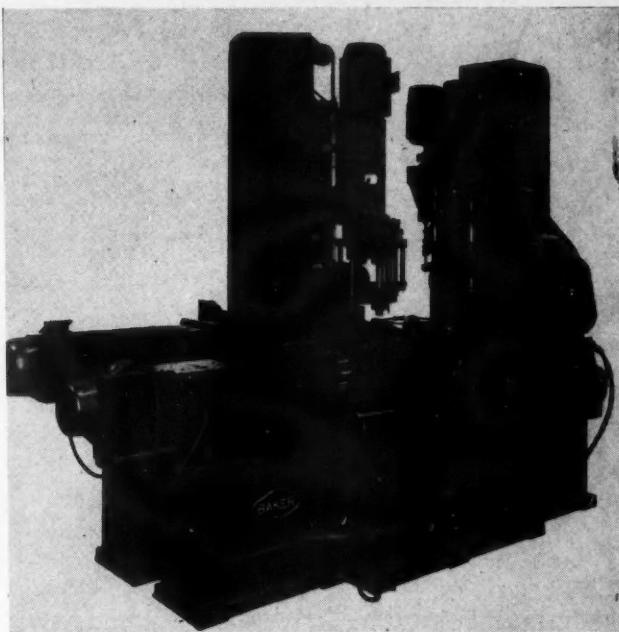


the rear of the pilot are taken up by an anti-friction bearing. The 10-deg angle of the pilot permits its use on different wall thickness of pipe. When the pilot is changed for different diameters of pipe it is only necessary to remove one screw in the center of the pilot.

The principle advantage of the spring pilot is that it centers the pipe true with the die head assuring concentric threads and permits of higher threading speed. Chatter is eliminated from the thread by the pilot and the chasers can be set further back of center thus increasing the clearance back of the cutting edge. This setting of the chasers is said to result in increased tool life and improved thread finish.

THE MARKET FORGE Co., Everett, Mass., has originated a new type of collapsible metal box for use with skid platforms. The skid platforms are provided with sockets to receive one in. standard pipe corner posts. Panels for the sectional boxes are 12 in. high and are provided with loops of steel which engage with the pipe-stakes in the platform. The panels are then slipped over the pipe-stakes and may be built

Special machine made by Baker Brothers, Inc.



loaded or removed. There are no bolts, nuts or rivets used in the construction of these sectional boxes.

THE MERCURY MANUFACTURING Co., 4118 S. Halsted St., Chicago, Ill., has added to its line a new die handler assembly. This assembly, as illustrated, is built into a Mercury "Mogul" five-ton high lift chassis. It can also be furnished on Mercury's three-ton chassis, in either high or low lift models.

This design consists of two power driven die movers, operating in machined slots at the sides of the load platform. Each die mover is driven by a compound-wound dc motor through a Brad-Foote Gyro speed reducer and roller chains. Independent control is effected by two push-button operated magnetic contactors. Push buttons are located on the operator's dash. Additional controls at the rear of the load platform may be had if desired.

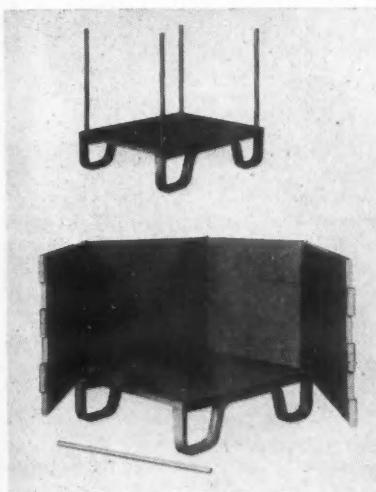
This assembly makes it possible for the operator to push the die from the load platform onto the press or storage rack or vice versa. Die movers may be retracted into slots at the rear of the platform for skid handling.

A MULTIPLE-UNIT, multiple-operation type machine, designed and manufactured by Baker Brothers, Inc., Toledo, Ohio, completes all drilling, boring, reaming, facing and tapping operations in production of gas regulator bodies. The material handled is cast iron.

This specially-designed machine has a four-station, automatic power indexing table, each station arranged for re-chucking one part, and the chucking of one new part. Built around this index table are 10 independently fed auxiliary units, consisting of four self-contained hydraulic units mounted in horizontal and vertical planes, one inverted rack and pinion feed unit, and five single-spindle lead screw tapping units also mounted in horizontal and vertical planes.

Operations in parts present themselves from five directions, and all holes from the horizontal units have two separate operations. The main hole from the vertical plane is machined in five separate operations.

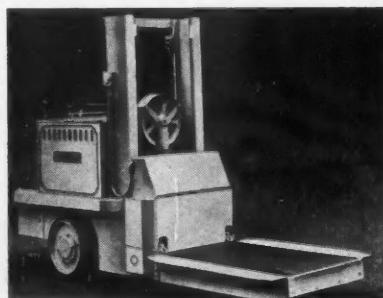
Flexibility is required in the machine, due to various sizes of the regulator housings, some being $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in. pipe tap and flange holes varying with eight holes on one bolt circle, and 10 holes on a different bolt circle. The multiple head furnished on the unit at first working stations has 18 spindles arranged to pivot to accommodate varying bolt circles without removing head from unit.



Market Forge collapsible metal box

up to any height. These panels are all steel.

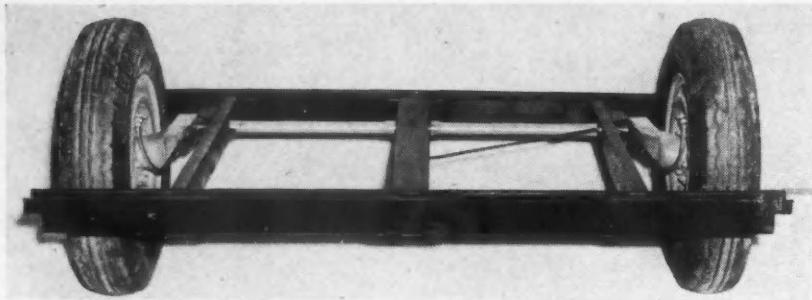
Some of the features of this type of box section are as follows. When not in use the panels stack very readily and occupy very little space. Because of the design and construction and the interlocking character of the panels, each panel reinforces the adjacent panel. It is possible to equip the skid platform with sides only or with ends only, or two sides and one end, or two ends and one side. It is also possible to leave out any portion of a side or end for ease in loading and unloading material. One stake may be removed and then adjacent side and end opened as if hinged, thereby exposing the skid platform so that materials may be easily



Mercury die handler

A HOT-BLADE wire stripper for continuous production stripping has been placed on the market by Ideal Industries, 3000 Park Ave., Sycamore, Ill. Through use of two electrically-heated stripping blades, the unit will strip cotton, silk, synthetic (plastic) insula-

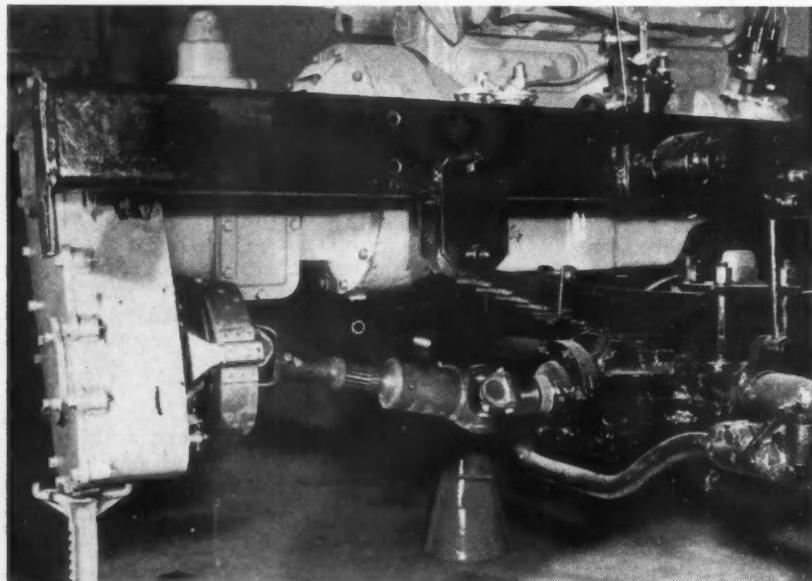
(Turn to page 68, please)



Rear view of the torsion-bar rear suspension. The center ends of the bars are rigidly mounted, and the spindle-arm ends supported in large, bronze, pressure-lubricated bearings.

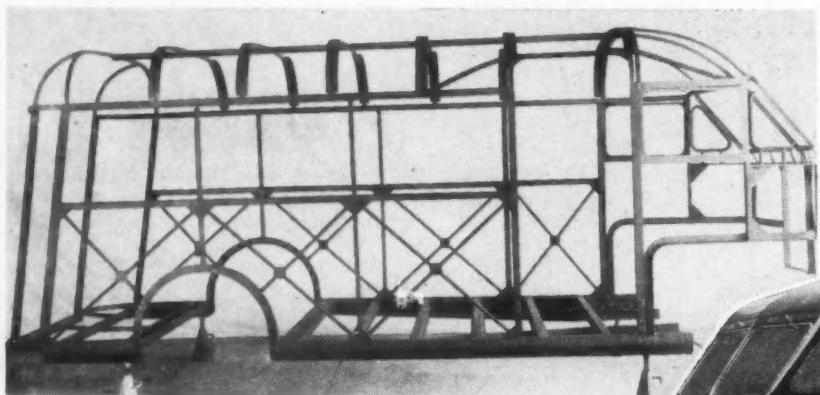
Details of Front Drive, Torsion Bar Suspension and Stressed Body Frame on

Linn Delivery Coach



TORSION-BAR rear suspension with individually sprung wheels, a stressed body frame, and a removable front drive power-unit assembly are primary features of the new 1½ Ton Linn Delivery Coach now in production at the Linn Coach and Truck Corp., Oneonta, N. Y. Details of these features and specifications are presented on this page.

Side view of the Timken front-driving and steering axle shows the transfer case and propeller shaft. The power plant and drive train are removable as a unit.



(Above) The body for the integral body-chassis has a welded trussed steel structure. Its exterior covering is 0.040 in. aluminum and the interior lining is plywood. (Right) The Linn Delivery Coach has a low-level floor 16 in. from the ground.

Specifications

Engine: Hercules QXC3, six-cylinder. Displacement 221 cu in. Bore 3.375 in., stroke 4.125 in. Torque 154 lb-ft.
Weight: Unladen, 5600 lb; Rated load 1.5 tons.
Wheelbase: 154 in.
Brakes: Lockheed hydraulic.
Transmission: New Process with four speeds.
Transfer case: Linn-Morse 4 in. Silent Chain.
Drive: 4 in. Morse Silent-Chain, ratio 1 to 1.
Propeller shaft: Universal Products propeller shaft and universal joints.



NEW Products

New Line of Timken 3-for-1 Rear Axles

A new line of Timken 3-for-1 rear axles in a complete range of sizes for truck capacities extending from a GVW rating of 14,500 lb to a GCW rating of 58,000 lb, with each size axle available with three types of final drives, is announced by the Timken-Detroit Axle Co., 100 Clark Ave., Detroit 32, Mich.

There are seven basic axles in the new line, the E, H, L, Q, R, S and U Series. The E Series through the R Series offers a choice of three types of final drives including hypoid single reduction, hypoid-helical double-reduction and two-speed hypoid-helical double-reduction. The S and U Series heavy-duty axles offer a choice of hypoid-helical double-reduction or two-speed hypoid-helical double-reduction final drive. In each series axle the optional types of final drives are interchangeable in the same axle housing using the same axle shafts. It is from this feature of interchangeable final drives that the Timken "3-for-1" axle derives its name.

All axles have the same features of construction, the same interchangeability of parts, and the same performance characteristics throughout the entire range of sizes. They differ only in load carrying and torque transmitting capacity.

New high performance hypoid gearing is employed in the single-reduction hypoid drive, for the first gear reduction in the double-reduction drive, and in the two-speed double-reduction drive. The second reduction in the latter two types is through helical spur gears. Timken 3-for-1 axles offer for the first time, it is claimed, hypoid gearing in three types of final drives throughout the entire range of capacities.

All two-speed final drives are equipped with the Timken Easy-Power

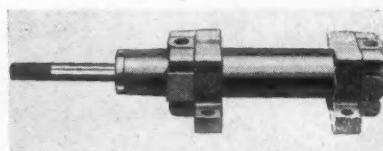
shift. This built-in mechanism, actuated by vacuum or compressed air, eliminates the need for manual shifting.

The Timken 3-for-1 axles have been designed to be equipped with either hydraulic or air-actuated brakes. New Timken "DP" Dual-Primary hydraulic brakes may be specified for all series of 3-for-1 axles. The Timken "P" Series air brakes are available for all axles except the E Series.

Another feature is outside-mounted brake drums. This type of construction permits removal of hubs and drums, to make the brake mechanism accessible for inspection and service, without removing the axle shafts or disturbing the wheel bearing adjustment.

Standard and Special Hydraulic Cylinders

Hydraulic cylinders with seven standard mountings which cover most needs in initial equipment are an-



Natdraulic cylinder

nounced by National Hydraulic Co., Inc., 4505 Oakwood Blvd., Melvindale (Detroit), Mich. The cylinders are furnished in bore sizes of 1 in. to 12 in., stroke any length, and for operating pressures up to 1500 psi with a 5-1 factor of safety. A novel construction that has eliminated tie rods and streamlined the Natdraulic cylinder is said to make practical a more simplified design of

the machines in which it becomes a part. Other features include cast Meehanite heads, long bronze side-thrust bearings, special alloy steel rods, alloy steel seamless tubing bored and honed to a mirror finish. Special cylinders are designed and engineered for special tooling, including forged cylinders for highest commercial pressures.

General Purpose Photoelectric Counter

A completely packaged, easily-installed, general-purpose photoelectric counter, the Type P1, has been brought out by Photoswitch, Inc., 77 Broadway,



Photoswitch photoelectric counter, Type P1

Cambridge, Mass. It consists of a photoelectric control, light source, and electric counter. The only equipment which needs to be located at the point-of-count is the control and the light source. One or more electric counters (containing the counter face and reset knob) may be placed at any convenient location and wired to the control.

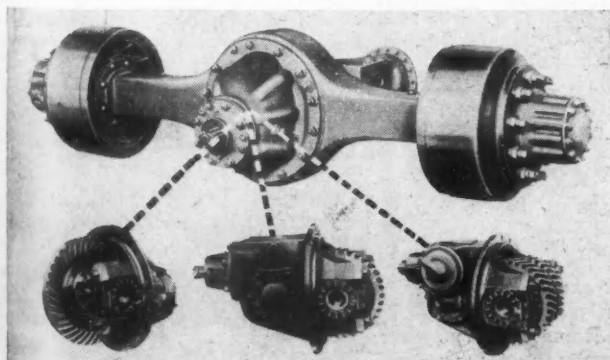
No wiring is necessary. The control has a line cord with a male plug connection which fits any standard lighting outlet. This supplies the power for the light source and electric counter, which in turn have cables and plugs for plug-in connection to the control.

Photoswitch photoelectric counter Type P1 is recommended by the manufacturer for counting on loading chutes and conveyors, for remote counting, for counting small objects and freshly painted and hot objects, for counting textile piece goods and leather goods, for selective counting by height or length, and for counting the output of punch presses and screw machines.

Soluble Cutting Oil

Gulf soluble cutting oil, is a new product of the Gulf Oil Corp., Pittsburgh, Pa.

The new product is claimed to be the only soluble cutting oil which combines,

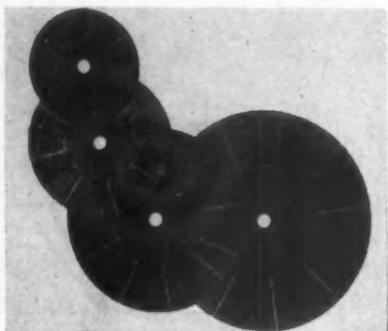


Timken 3-for-1 axle

together with all-water miscibility, the qualities of high lubricating value, extreme stability, pleasant odor, and non-foaming and rust preventive characteristics.

Ripper Cut-off Wheel

Designed on the same principle as the ripsaw used in woodworking, a new Ripper abrasive cut-off wheel has just been introduced by American Emery Wheel Works, Richmond Sq., Providence, R. I. This new wheel is unique in having a "set" which is claimed to allow it to cut cooler and faster—and

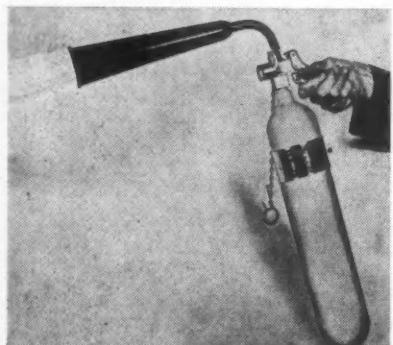


Ripper abrasive cut-off wheels

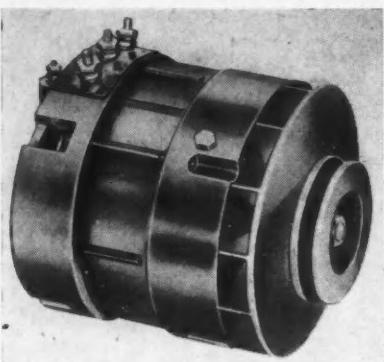
last longer. The sides of the wheel are made with radial depressions .006 in. to .008 in. deep, extending from the flange area to the edge of the wheel. Minimum thickness of wheel is 1/16 in. in 6 in. and 3/32 in. in 8 in., 10 in. and 12 in. sizes. The Ripper wheel may be used on both portable and stationary cut-off machines. It is manufactured in sizes 6 in. to 12 in. diameter in the proper "American" grit and grade to cut all materials from steel to stone.

Compact Fire Extinguisher Weighs Under Four Pounds

American-LaFrance-Foamite Corp., 8 E. LaFrance St., Elmira, N. Y., has added a new small fire extinguisher to its line. It is called the Alfo-Speedex—with contents weighing only 3½ lb,



Alfo Speedex fire extinguisher



Leece-Neville alternator

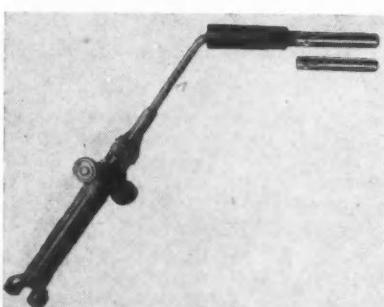
but which expand upon release to 450 times their contained volume.

It is only 3 9/16 in. in diameter with an overall length of 22 in. It is operated by quick acting squeeze-type valve which releases the carbon dioxide extinguishing agent by palm pressure.

Speedex carbon dioxide gas is non-poisonous, non-corrosive and odorless. It is a non-conductor of electricity, and will not freeze at any climatic temperature. It is heavier than air and will not support combustion.

New Accessory for Welding Torches

An accessory which affords double duty for oxy-acetylene welding torches has been originated by Cesco Products, Inc., 30 N. LaSalle St., Chicago 2, Ill.



Cesco Puddler

Known as the Cesco Puddler, this new unit fits over the end of any standard welding torch tip. It is used with acetylene alone and is claimed to provide an ideal flame for body soldering, tinning, silver soldering and heating jobs. Two tips are furnished with the kit—one for light duty soldering and one for body soldering.

Masonry Drills with Carbide Tips

A line of Red Streak carbide tipped masonry drills has been placed on the market by Vascoloy-Ramet Corp., North Chicago, Ill. Constructed with

generous sized carbide tips, the drills are obtainable in off-set and straight shank designs in drill diameters of .198 to 1.535 in. Adaptable for any rotary powered or hand drill, the Red Streak masonry drills are specifically designed to drill concrete, bricks, tile, slate and all other non-metallic materials.

Alternating Current Generating System

Leece-Neville Co., 5363 Hamilton Ave., Cleveland 14, Ohio, is making an a-c generating system for six and 12-volt service on all types of mobile equipment requiring extra-high current output at low and high speeds to maintain batteries.

Consisting of alternator, voltage regulator and rectifier, six-volt, the system weighs 40 lb. The alternator is of simplified design, having no commutator or rotating armature windings. The 12-volt version of this new system weighs 42 lb.

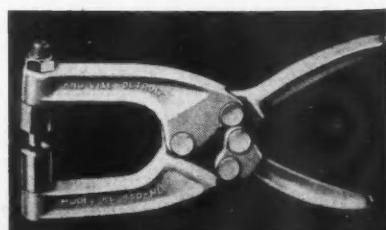
Chief advantage claimed for the six-volt system is its ability to deliver 25 to 35 amp at engine idle speed and 60 amp from 12 to 15 mph to top car speed. Leece-Neville states that this new generating system can practically eliminate the need for recharging when installed in connection with a battery in A-1 condition.

When the correct drive ratio is provided, the 12-volt equipment delivers 100 amp at engine idle speed as well as at full engine speed. There is said to be no danger of burn-out because the alternator has no commutator. Rotation can be reversed without affecting system connections or performance, and the system can be used for series-parallel circuits where 24-volt cranking is required.

Knu-Vise Hole Locator

By means of a new hole locator, designed by Knu-Vise, Inc., 2200 8th St., Detroit, Mich., several sheets of metal can be quickly aligned to position them for riveting, spot welding or drilling.

The new device looks like ordinary pliers and operates as simply. This model, catalogued as KL-450-HL, has a toggle-action which automatically locks upon the work held, leaving operator's hands free to perform other work. An easy motion separates the handles to release the pliers.

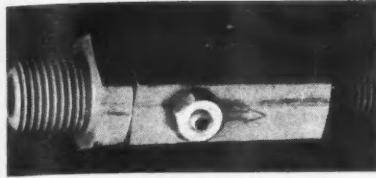


Knu-Vise hole locator

The pressure spindle can be adjusted to admit work up to $1\frac{1}{4}$ in. thick with locating pins available in all popular diameters. The hole locator is 8 in. long and 3 in. wide and is capable of holding a maximum of 500 lb. It weighs 22 oz.

Speed Control Valve with New Metering Device

A speed control valve incorporating a new metering device, has been de-



Electrol speed control valve

veloped by Electrol, Inc., Kingston, N. Y. While allowing free flow in one direction, it controls precisely the flow in the opposite direction, by means of a metering pin rather than by regulation through the main orifice. This rate of flow in opposite direction can be changed to suit individual installation by the adjustment of the screw-actuated metering pin, set in one of the hexagonal sides.

The new valve can be used with pressures up to 1500 psi, and even higher if desired. It can handle air, oil and water, at both high and extremely low pressures.

The standard Electrol speed control valve has $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in. NPT port sizes.

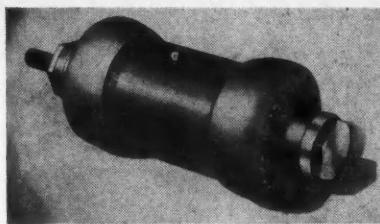
Plastic Coating for Plating Racks

An odorless, non-inflammable plastic coating for plating racks is offered by Peninsular Chemical Products Co., Van Dyke, Mich.

Known as Pen-Kote 590, this material consists of an aqueous dispersion of Saran plastic and contains no organic solvents. It is said to be tough, flexible and highly resistant to all plating and cleaning solutions, including chlorinated degreasing solvents. It is applied by hand dipping and dries in less than an hour at room temperature, giving complete protection in 24 hours. Because it is an aqueous dispersion rather than a solution, it is exceptionally free-flowing, draining rapidly without forming webs or strands to be trimmed off after dipping.

Non-Cushion Type Air Cylinders

The Modernair Corp., 4222 Hollis St., Oakland 8, Calif., is marketing a line of non-cushion type air cylinders, complementing its presently manufac-



Modernair cylinder

tured line of cushioned-type cylinders. A feature is the utilization of threaded cylinder caps, sand cast of special aluminum alloy and heat treated to give high tensile strength. The Modernair unit permits the caps to be rotated 360 deg on the cylinder without affecting the permanence of the seal.

Aircraft type "O" ring packings are

used throughout the cylinder at every possible point of wear or leakage. Because of this feature, there is no metal-to-metal contact at any point of wear.

This Modernair cylinder is produced in a standard range of 2 in., $2\frac{1}{2}$ in., 3 in., and 4 in. diameter, the stroke length is optional. Any stroke length desired can be quickly supplied to fit each individual stroke requirement. Completely corrosion-resistant, this cylinder can be actuated by air, water, or oil.

Oxyarc Process for Cutting Stainless and Alloy Steels

Arcos Corp., 1515 Locust St., Philadelphia 2, Pa., has developed a new method for hand cutting or piercing

(Turn to page 78, please)

Rear Individual Wheel Suspension Analysis

Compiled by Austin M. Wolf, Consulting Engineer and presented at the SAE Annual Meeting. For abstracts of other SAE papers see page 30.

GENERAL CLASSIFICATION	TYPE	SUSPENSION (SPRING)	UNIVERSALS	EXAMPLE
Swinging axle (Transverse plane alignment)	Segmental inner ends Segmental flanges Forked inner ends Forked inner ends Forked inner ends Spherical inner ends with guides (equivalent of fork) Spherical inner ends	Cantilever Transverse leaf Coil Transverse leaf Transverse leaf and coil Coil Coil in tension Transverse center semi-elliptic and trans. cantilever each side Transverse leaf and radius rods	None None 2 2 2 2 2	Rumpf Tatra Mercedes Skoda Maybach Renault (1946) Tudor (1948)
Swinging axle (Varying alignment)	Spherical inner ends	Transverse leaf and radius rods	None	Austro-Daimler
	Spherical inner ends	Transverse leaf and rear radius rods	2	Steyr
	Spherical inner ends	Torselastic and diagonal radius rods	2	Wanderer
	Spherical inner ends	Transverse leaf and radius rods	2	Adler
	Spherical inner ends	Torsion bar and flexible radius rod	2	Goodrich
	Spherical inner ends	Longitudinal spring	2	Hansa Lloyd
Support arm rigid		Rubber torsion (conical disc) Air Transverse pivoted leaf Transverse leaf Torsion bar Lever against coil	4 4 4 4 4	Volkswagen Willys-Overland 6-70 (1946) Campbell Faudi Lancia "Aprilia" Cord* Kaiser* (1946) Chevrolet (Dubonnet) Front** Claveau* (1946) Volkswagen Front**
Longitudinal	Trailing arm Leading arm	Single Double Lever against coil Torsion bar Lever against coil Lever against rubber in compression Any type	4 4 4 4 4 4 4	Harris Leon Laiene Harris Leon Laiene Turn front drive chassis around (those with trailing arm) German example (Hale paper) Citroen* Barnardet* (1946) Mathis* (1946) None None; requires vertical guide Cottin Desgouttes, DKW*, Zundapp, Gregoire* Parenti Alvis* None; requires vertical guide Hotchkiss*, Skoda Minor* Leaf Spring Institute
Support arm, elastic	Transverse; 2 links or wishbones Diagonal Longitudinal	Rubber torsion Longitudinal torsion bar lowe Coil on upper Any type Leaf spring or springs	4 4 4 4	
	Transverse	2 leaf springs	4	
		3 leaf springs	4	
	Diagonal	4 leaf springs	4	
		Leaf spring or springs	4	
Combinations	Transverse	Side wishbone and transverse spring above	4	
	Transverse and diagonal	Side wishbone and transverse spring below 2 transverse, leaf springs and diagonal radius rods	4 2	
Vertical guide		Any type	4	Wolf None

* Front drive transposed to rear.
** Transposed to rear and drive added.

NEWS *of the* Industry

Major Changes Planned for 1948 Model Fords

An interesting development in the lightweight car question came out of the talk given before Ford dealers in Boston recently by Jack Davis, vice-president in charge of sales and advertising. He reported that surveys have convinced Ford that the public does not want to give up the size, comfort, riding comfort, and general convenience of present day automobiles in favor of a smaller, lightweight, stripped down version. He also reported that the 1948 Ford will be lighter in weight and will represent the most radical change in Ford design since the introduction of the Model A in 1928. One of the changes reported to be a certainty is the elimination of the old transverse springing, harking back to Model T days, in favor of independent front wheel suspension on coil springs and conventional springs at the rear. It also has been confirmed that the 1948 Ford will not be the light car previously discussed. It is understood that the light car division, as such, has been abandoned and that the light weight car project has been returned to the realm of research.

Light Car Development By No Means Dead

On the basis of unofficial but reliable external evidence, Chevrolet still is interested in the possibilities of light car development. Several suppliers have reported that they expect soon to get the go ahead on tooling. Also it is known that the Chevrolet-Cleveland division, official designation of the light car project, remained virtually intact so far as top personnel is concerned, after the decision last fall to defer the project until the materials situation cleared. It now is understood that the whole light car program is due to come up for review in the near future to decide whether the time is propitious. It also is reported that experimental cars have been tested at the GM proving ground. Weight and details are a top-drawer secret, naturally, but reports that have filtered out indicate that the design is entirely new and not a stripped down version of the Chevrolet. At any rate, the project, if re-instituted now, could not start turning out cars until some time well into next year at the earliest. It would take a year or more to build the large plant planned at Cleveland and to organize, tool, and equip it for production.

**Most Radical Design Changes
Since Introduction of Model
A Expected in 1948 Fords
... Chevrolet Still Interested
in Light Car . . . General
Motors Develops Lightweight
Car for Australian Production
... GM Increases Prices
of Some Models . . . Ford to
Enlarge Field for Six-Cylinder
Line . . . Ford Price Cut
Recalls Similar Move in 1921
... Industry More Cheerful
Over Labor Situation . . .
Truck Production Sets New
Record.**

GM Planning to Build Light- weight Car in Australia

While there has been much discussion about an American lightweight automobile, which presumably would be cheaper than present models, General Motors has proceeded to engineer a light automobile which it will build in Australia. Already it has dispatched a contingent of about 80 employees and their families to that country to get the project started. Although the corporation is very close-mouthed about details of the car, it is known that the engineering is largely completed and several cars have been thoroughly tested at the proving grounds and are now said to have been shipped. According to present plans production should get underway by next March or April. The technical personnel sent to Australia are understood to have been sent there to get the project running and then to return to this country after from three to five years, leaving the entire job in the hands of Australians.

A Boiled-Down Version Of GM Price Increases

Here is a summary of what M. E. Coyle, General Motors executive vice-president, has to say about GM price increases: No increases on any of the volume models by any GM division. No Chevrolet changes. No changes in any volume model of Cadillac, Buick or Oldsmobile. Prices of convertibles and station wagons of these three makes are adjusted to bring the selling price more nearly in line with cost. Prices of Pontiac station wagon and convertibles similarly corrected. Also a

further correction of approximately \$18 was made on Pontiac 8-cylinder models to bring the price more nearly in line with cost.

Ford to Increase Use Of Six-Cylinder Engines

While the Ford V-8 engine has been emphasized to a great extent in sales and advertising, the company now is quietly preparing to enlarge the field for its six-cylinder line, especially in light trucks. Current national advertising also is laying more stress on the six-cylinder engine for passenger cars. This in-line motor was built in large quantities for military vehicles during the war and has proved a rugged and dependable performer. Production facilities were built up, and it now appears that Ford is going to push this line much more vigorously than in the past. First efforts are being concentrated in the light truck line, where more than half the light duty jobs currently are using it. It is optional in all Ford offerings, but only a few heavy duty trucks and about 15 per cent of the passenger cars now carry the six. The engine is rated at 90 hp., but there are plans now for stepping this up, possibly to 100 hp., the same as the present V-8, through redesign. Another angle behind the shift to more sixes is that it is cheaper to build and maintain than the eight. Being compact, there are obvious economies, such as only one cylinder head, two fewer pistons, rings, connecting rods, etc. With the coming battle against higher prices and competition, the six may be one answer in Ford's quest for lower manufacturing costs. It is a development that will bear watching. In fact, there is some speculation that the 1948 Ford, which is known to be radically different, will use the redesigned six engine, leaving the Mercury with the V-8 line. If that should occur, Ford would compete on better footing with Chevrolet and Plymouth so far as engine cost is concerned.

Ford Price Cut Has Historical Precedent

To many old timers in the industry, the recent Ford price reduction recalls the historic and similar move made by Henry Ford in 1921, when he cut prices of his cars while he still had 150,000 unfilled orders on hand. Then, too, prices were high and a buyers' strike had begun to develop, but prices all along the line stabilized in a few

months and in the following years the automobile industry grew and prospered fabulously. On Jan. 1, 1947, the backlog of orders called for 1½ million vehicles.

It should be remembered that Ford is unique among automobile manufacturers in the matter of policy decisions. Being entirely family owned, the company has complete freedom of action in this respect, whereas others are forced to consider the reaction of their thousands of stockholders. Ford can elect to write off past losses, whereas other companies which also have had large deficits, cannot take such responsibility without possible serious repercussions from investors who would like to see working capital and reserves replenished before profits are reduced voluntarily.

Henry Ford II reported that the company made a modest profit in the last quarter of 1946, and there are signs of increasing productivity of labor in Ford plants. The long term view on materials also is better, he said, so that the company expects to continue operations in the black after writing off large losses incurred since VJ Day.

Suppliers' Reaction is Favorable

Suppliers naturally wondered whether the Ford price cut meant an effort to reduce their margin. However, in a letter to vendors, Albert J. Browning, director of purchases, said that was not the intention, but that with the period of strikes and interrupted production apparently past, the company hoped suppliers' prices could be held at reasonable levels. Several responded with pledges to hold prices, and one even offered to reduce them.

Industry More Optimistic Over Labor Outlook

There are several indications that the automotive industry is more cheerful over the labor situation than it has been for many months. There always

is a possibility that some labor leader will tip over the apple cart, of course, but all signs point to a much more reasonable attitude on the part of unions than prevailed through 1946. Demands will be made, but there is a growing feeling of optimism in Detroit that the wage question can be settled without strikes for a very moderate sum, probably 10 to 12 cents an hour at most.

While the pronouncements for public consumption are about as pugnacious as ever, observers close to the inside thinking of UAW-CIO are convinced that its leaders are stepping much more softly. One reports that a high official recently returned from a swing around the locals with a pretty definite idea that the rank and file definitely do not want to strike. There are several reasons, such as depleted savings, fear of Congressional wrath, the present high cost of living while not working, and just being fed up with labor strife in general.

UAW-CIO Polling Members for Ideas on Retirement Plan

Leaders of both Ford and General Motors locals of the UAW-CIO have been busy sounding out their members on what they would like to have in the way of a retirement plan. About one out of 20 is sent a questionnaire asking for suggestions about how much the monthly benefit should be, at what age it should start, whether it should be administered by the union or the company, or both, and similar questions. An obvious defect on the project is that it assumes a knowledge of retirement plan economics on the part of the employee, whereas actually the whole subject is a very complex one of actuarial tables and other data entirely beyond the comprehension of the average person. Automobile manufacturers are known to be collecting data on retirement plans, and undoubtedly will have plenty of information at hand

when the question is brought up formally in negotiations. However, none as yet has indicated that it is prepared to go beyond the discussion stage. Best guess now is that the unions do not seriously consider getting their objective this year on retirement plans, health, benefits, etc., but hope to make some headway on these long range goals.

Truck Production at All-Time High Rate

Automotive truck output climbed to an all-time record of 940,583 civilian type units in 1946, according to the Civilian Production Administration. Production reached 1,042,083 in 1941 but this total included 218,880 military type trucks.

However, passenger car production reached only 2,155,924 units, substantially less than normal annual peacetime production.

From the News Notebook: Kaiser-Frazer is running along at more than 300 cars a day, with a high of more than 400 reached one day early in January. K-F has installed 21 new presses and now stamps its own front fenders, hoods, upper cowls, and rear quarter panels. Roof panels will be turned out soon . . . Nash has been operating on a schedule reduction of 25 per cent because of a lack of sheet steel, but hopes to return to full output soon . . . Ford's Edgewater, N. J., plant lost 68 production days last year because of strikes or parts shortages in other plants . . . Oldsmobile built 119,328 cars in 1946, with production hitting 1000 a day in December . . . Pontiac six and eight engines soon will have vacuum metering carburetors which automatically feed the engine a slightly richer mixture during part throttle acceleration . . . Henry Ford II thinks that union officers should be elected for two-year terms, or even four years, to reduce the time spent in electioneering.

1947 Chevrolet

New treatment of fenders and hood, a more massive radiator grille, and several minor mechanical refinements constitute the important changes in Chevrolet's 1947 line of passenger cars. Eleven models are offered in the Fleetline, Fleetmaster, and Stylemaster series.



Mr. Tucker Tells About His Car

As Related to Joseph Geschelin

In a special interview with Preston Tucker of the Tucker Corp., at what was formerly the Dodge Plant in Chicago we were enabled to visualize the plans and objectives of the latest entry in the motor car field.

Although complete specifications details of the Tucker car are not yet available for publication, we have been authorized to give a perspective of some of the major features to clarify the record. The car will be built on a 126 in. wheelbase in one body style for some time to come. In keeping with the general emphasis on safety, the body will be of Tucker design and will incorporate a strong framing of steel in longitudinal and transverse members to provide a rigid backbone for the attachment of body panels. With this type of construction body panels will be broken down into small sections to simplify press shop operations.

It is quite possible that at the start Tucker will buy the body panels from an outside source. However, he contemplates buying some triple-action presses and when these are available, he will set up his own body making facilities. Incidentally, the body is to be of all-steel construction rather than of aluminum as has been stated by some writers. The hood, trunk lid, and doors are designed to use aluminum only if there is a shortage of deep drawing sheet steel.

Unconventional Chassis Frame

Another feature contributing to the strength of the body and, consequently, to safety is the use of a chassis frame so shaped as to follow the outside sill contour of the body all around.

The Tucker car will have a rear engine drive and independent suspension on all four wheels. The arrangement of the drive and suspension are quite unique and worthy of study. Consider first the engine. This is 5-in. bore by 5-in. stroke, six-cylinder, of horizontally opposed cylinder type with a six-throw crank shaft. Liquid cooled, the engine will feature a sealed pressurized cooling system, possibly using Prestone for year round operation.

A minimum output of 150 hp is expected at moderate speed with a compression ratio of 8.5 to 1. As will be noted later the compression space is held accurately by machining both the cylinder head and piston dome. Interesting feature is the adoption of a low pressure type solid fuel injection system to replace conventional carburetion. Unusual low speed torque and operating characteristics are anticipated through the adoption of an ultra high frequency ignition system, using 24-volt starter and generator as standard equipment.

Engine structure is of aluminum, featuring two banks of cylinders — three

bore to each bank—the banks being mutually interchangeable. These cylinder blocks have blind end bores terminating in a spherical dome which is machined simultaneously with the boring of the holes, the doming tools being a part of the boring bars. The engine will not have cylinder sleeves. Instead of sleeves, Tucker plans to spray the bores with a special Ampco aluminum bronze alloy having the same coefficient of expansion as the aluminum alloy block and piston. With this design the bore will be finished in one operation by diamond boring after a preliminary rough boring.

Pistons are of aluminum allow with short skirt similar to aircraft practice. The dome is of spherical form to mate with the cylinder head formation and will be finished to good tolerances.

The engine has a dry sump and carries surplus oil in the lubricating system, and is so designed that if oil drops to the danger level the engine will stop before bearings or other parts can be damaged.

Coming to the final drive arrangement, the engine is installed transversely and mounted in the frame so as to constitute fully sprung weight. Attached to each end of the crankshaft is a special type of hydraulic coupling, which, possibly in combination with a gear box at each end, provides the hydraulic drive to the two rear wheels. Short drive shafts from each coupling transmit power to the wheels through conventional universal joints. Provision has been made to install constant-velocity joints if experience proves these are desirable.

The suspension at each corner is quite unique, and stems from suspensions used in Tucker racing cars. It consists of two parallel arms fastened to the knuckle at the wheel and to the frame at the other end. Latest development is the adoption of rubber springs at the frame hinge, using rubber in shear. These elements probably will be supplied by United States Rubber Co. At the present time it is felt that shock absorbers may not be necessary. However, provision is made for shock absorber installation in the parallelograms if this is found desirable later on.

Ventilated Disk Brakes

Another departure from the conventional is the use of hydraulically-actuated, ventilated disk brakes, an outgrowth of racing car practice. These are said to be extremely powerful but gentle in application and long lived.

The radiator is of small size and will be mounted at the front with plumbing to the engine in the rear. Hydraulic coupling housings, brake housings, etc., are of aluminum.

One of the questions uppermost in everyone's mind is what of the plant and its facilities. In the first place, Tucker proposes to use only part of the available area, something over three-million sq ft in one section of the plant. What about manufacturing facilities? It is a matter of note that Tucker claims to have succeeded in getting WAA to leave the original Dodge aircraft engine production facilities practically intact. At this moment the plant contains paint spray and drying oven facilities—fully mechanized—far beyond the needs of the operation. It also has some of the most modern heat treating equipment available today. Actually Tucker estimates that very little new equipment will be necessary, save for items such as heavy presses for body panels, the major new investment being in the form of tools and fixtures and the re-arrangement of machinery and conveyors.

Existing Facilities to Be Employed

Just to show how completely existing facilities may be employed, it may be noted that the pistons for the new engine are quite similar both in size and form to the aircraft piston formerly produced by Dodge. Tucker anticipates a considerable salvage not only of fixtures but of cutting tools as well.

They expect to adapt the boring machines in the plant for boring cylinders and will dispense with honing equipment.

The gist of it is that Tucker has succeeded in acquiring not only the biggest plant in one place but has the added advantage of finding it equipped with almost every kind of production facility required for his operation. That is really a remarkable stroke of luck or fortuitous circumstances since in almost all other deals of this kind the Government has denuded the production facilities and put them on the block for sale as surplus.

According to Tucker, the lease arrangements have been successfully negotiated although the lease has not yet been signed. Naturally a considerable stock issue will have to be floated in the very near future to meet SEC and WAA requirements. Tucker claims his underwriters are most optimistic and ready to move rapidly.

Additional capital will be obtained by means of a dealer and distributor program. Under this plan the dealer contract is for a two-year period and is based on potential buying power in each trade area as reflected by sales records of automobiles selling in a comparable price range. Retail price of the Tucker car has not been released, but it is said to be in the medium bracket.

In arriving at the sales price for franchises, the Tucker Corporation has established a formula based on payment of \$20 per car in each dealer territory. The average number of cars

(Turn to page 54, please)

PERSONALS

Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.

Ford Motor Co.—Thomas L. Hibbard, Director of Styling.

General Motors Corp.—GMC Truck & Coach Div.—Fred J. Limback, Administrative Asst. and General Auditor. Charles O. Ball, Chief Engineer, has announced his retirement. Succeeding Mr. Ball is Carl J. Bock as Chief Engineer. D. L. Tate, Divisional Comptroller, has retired and William F. Maybury has succeeded him.

General Motors Corp., Buick Motor Div.—Marx Kristek, Superintendent of final assembly building.

Willys-Overland Motors—George J. Edellstein, General Purchasing Agent.

Hudson Motor Car Co.—W. S. Milton, Director of Service.

Lockheed Aircraft Corp.—Bert W. Holloway, Sales Development Manager, succeeding Roy Campbell, Jr., who has resigned.

Fairchild Engine & Airplane Corp.—Andrew F. Haiduck, General Manager of Duramold Div.

Luscombe Airplane Corp.—James P. Cunningham, Vice-President; Eugene W. Norris, Vice-President in charge of engineering.

Perfect Circle Co.—Henry McKee, Market Research Director

E. I. duPont deNemours & Co., Inc.—Frank H. Ernst, Director Production of the Rayon Div.

Norton Co.—Howard W. Dunbar, Vice-president and General Manager of the Grinding Machine Division, has retired. He will be retained as a consultant and will act in an advisory capacity.

Timken-Detroit Axle Co.—Fred W. Parker, appointed assistant to the President.

General Motors Corp., Delco Products Div.—T. M. Dils appointed Plants Manager.

Motor Wheel Corp.—John E. Garkent, elected President, succeeding Harry F. Harper, who resigned on January 7th, 1947.

Bendix Aviation Corp.—William A. Mara, Director of Advertising.

The Bristol Co.—H. E. Beane, appointed General Sales Manager.

Dearborn Motors Corp.—James H. Marks, appointed consultant to co-ordinate the procurement and engineering of farm implements. Arthur H. Kitson, appointed to Sales Staff and Vernon E. Nickel, Director of Consumer Research.

Young Radiator Co.—John P. Wahlen, Sales Engineer, Heating, Cooling and Air Conditioning Div.

Clark Equipment Co.—Retirement is announced of Edwin B. Ross, Vice-Pres. in Charge of sales and Ezra W. Clark, Vice-Pres. and General Mgr., Tructractor Div. E. M. Schultheis has been appointed Manager of Sales; T. F. Schrag, Sales Mgr., Automotive Div. and James

H. W. Conklin, Sales Mgr. of Trauctractor Div. Leo A. Bixby, appointed Manager of Engineering; E. J. Dunham, Chief Engineer, Tructractor Div.

The General Tire & Rubber Co.—A. Ray Carr, Sales Promotion Mgr.

Goodyear Tire & Rubber Co.—Thomas E. Wilson and B. A. Polksky, elected to the Board of Directors of the company.

The B. F. Goodrich Co.—Warren H. Hackett and E. A. Doerschuk, Assistant Treasurers.

Snyder Tool & Engineering Co.—Joseph Savage, Factory Manager.

Insuline Corp. of America—Victor M. Harkavy, Engineer in charge of new product development and design.

Pittsburgh Plate Glass Co.—Retirement of Robert L. Clause as vice-chairman of the board of directors.

National Hydraulic Co., Inc.—George W. Guirl, Director of Sales and Adv. Fedders-Quigan Corp., Radiator Div.—A. F. Ihde, Sales Mgr.

Davey Compressor Co.—Paul V. Goodman, Director of Purchases.

McCulloch Producing Engines In New West Coast Plant

The move of a major industry to Los Angeles was officially completed late in December when Robert P. McCulloch, president of McCulloch Motors Corp., announced the beginning of mass production of gasoline engines in a new plant located adjacent to the Los Angeles airport. The company was originally established in Milwaukee, Wis., as McCulloch Aviation, Inc., and began its move to the West Coast in January, 1946. The change in name, which indicates the present wider scope of the company's products, occurred in October.

The new plant, which cost approximately \$1,600,000 to build and equip, has a capacity production of more than one engine a minute. Production during the month of January, 1947, was 4300 engines, with increases planned

during successive months until the capacity of one engine a minute is reached. At that time, employment is expected to be about 1000 workers.

The first engines to be produced in volume are the Series 1200, of which there are at present four models, ranging from $2\frac{1}{2}$ to 4 hp. All major parts of these engines are high-pressure, aluminum alloy die-castings, with the exceptions of rods, crankshafts, and cylinder sleeves. Series 1200 engines are the two-stroke, air-cooled type, and are said to incorporate many advanced features.

Also in production, but in lesser quantities, are the Series 4300. These are opposed-type, two-stroke engines designed to develop extremely high horsepower (per lb) for use in target aircraft.

Development and experimental programs on other types of engines up to 125 hp, for use in the automotive, aviation, marine, and other industries, is being carried on concurrently with the production of standard models.

Colwell Appointed Chairman of SAE Technical Board

Appointment of A. T. Colwell, of Cleveland, Ohio as 1947 chairman of the SAE Technical Board has been announced by General Manager John A. C. Warner of the Society of Automotive Engineers. Mr. Colwell, who is past-president of SAE and vice-president of Thompson Products, succeeds J. M. Crawford, of General Motors Corp., Detroit, Mich., who becomes a member of the Board for three years.

Weekly Production of Cars and Trucks in U. S. and Canada

Week-ending	1947	Corresponding Week in 1941
Jan. 4.....	53,437	76,690
11.....	64,828	115,935
18.....	75,166	124,025
25.....	94,345	121,942
Total.....	287,776	436,598

Scooter that Fits into Automobile Trunk

This 75-lb, gas-line-powered scooter has just been announced by McCulloch Motors Corp. of Los Angeles. It is powered by a four-hp, 24-lb. McCulloch-built engine. The scooter will fit into the average automobile trunk and can be carried in the larger types of aircraft for emergency use. Production is scheduled to begin next month.



PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE and AVIATION INDUSTRIES. In making requests give title above the item concerning the publication desired, the date of issue in which it appeared, your name and address, company connection and title.

Industrial Ovens and Furnaces

The Paul Maehler Co.—Bulletin No. 27 containing general information regarding the three methods of heat transfer, conduction, convection and radiation. The bulletin is well illustrated and contains many charts, sectional drawings, dimension charts, etc.

Hydraulic Pallet Lift Truck

Lyon-Raymond Corp.—Bulletin 220 describes the company's hydraulic pallet lift truck. Included are photographic illustrations showing method of operation with pallets, recommended pallet construction and adaptability of various materials to palletizing.

Brass Collets

South Bend Lathe Works—Bulletin No. 83 describes a new line of precision draw-in collets made of brass. The bulletin contains a specifications table and table giving descriptions, prices, etc.

Tempering

Surface Combustion Corp.—4-page Bulletin No. SC-133 describes tempering in Surface Combustion Standard Rated Furnaces. It is well illustrated, describes different types of furnaces recommended for tempering of various kinds and shapes of ferrous objects. A table giving the effects of tempering temperatures on hardness is included.

Cutting Fluids and Coolants

D. A. Stuart Oil Co.—Technical Bulletin No. 5, Cutting Fluids and Coolants, is a symposium on cutting fluids and consists of four technical papers by authorities in the cutting fluid field.

Cylindrical Grinders

Norton Co.—Folder describing and illustrating the several types of grinders made by the company. A page is included illustrating the complete line of Norton machines, cylindrical grinders, surface grinders, tool and cutter grinders, Cam-O-Lap Lapping Machines, etc.

Knurling Tools

Universal Vise and Tool Co.—4-page illustrated folder analyzes in detail

how the Universal cam-action knurling tool greatly simplifies difficult knurling jobs.

Motorized HydroLectric Lift Truck

Lift Trucks, Inc.—6-page catalog with detailed diagrams illustrate the mechanical structure and dimensional specifications of the HydroLectric Lift Truck. Other pertinent facts and information concerning the lift are also included in the catalog.

Centrifugal Pumps

H. K. Porter Co., Inc.—Quimby Pump Div.—8-page pamphlet describing their close-coupled centrifugal pumps, Model Q. Selection tables for 50 and 60 cycle speeds, dimension tables and illustrations of screw pumps and rotex pumps are included.

Truck-Trailer Association Holds Annual Meeting

The Truck-Trailer Manufacturers Association, Inc., at its Sixth Annual Meeting held at Memphis, Tenn., Jan. 13-14, adopted an unofficial goal of 100,000 units for production this year.

Suppliers of the industry told the trailer builders they saw no reason why materials and components could not be provided in sufficient quantities

The suppliers, however, added two important qualifications to their assurances. They emphasized that they should be given sufficient "lead time" on orders in which to procure raw materials, and that orders placed should be "firm" and not subject to cutbacks or partial takings.

Members of the association elected the following officers to serve during 1947: President, J. L. Glick, Truck Engineering Corp., Cleveland, Ohio; executive vice-president, John C. Bennett, Utility Trailer Manufacturing Co., Los Angeles, Calif.; eastern vice-president, N. A. Carter, Jr., Carter, Inc., Memphis, Tenn.; treasurer, W. E. Grace, Hobbs Manufacturing Co., Fort Worth, Texas.

New AAPM Board Members

Election of new directors for Automotive & Aviation Parts Manufacturers, Inc., replacing those whose terms have expired, has been announced by the association. The following were elected to three-year terms by the membership at large: Wendell W. Anderson, president, Bundy Tubing Co., Detroit, Mich.; R. H. Daisley, vice-president, Eaton Manufacturing Co., Detroit, Mich.; F. C. Greenhill, president, Acklin Stamping Co., Toledo, Ohio.

Elected by the board, for three-year terms, are: K. J. Ammerman, assistant to president, Borg-Warner Corp., Chicago, Ill.; Clarence C. Carlton, vice-president and secretary, Motor Wheel Corp., Lansing, Mich.

John Airey, president of King-Seeley Corp., Ann Arbor, Mich., has been elected president of the association for 1947-48 by the board.

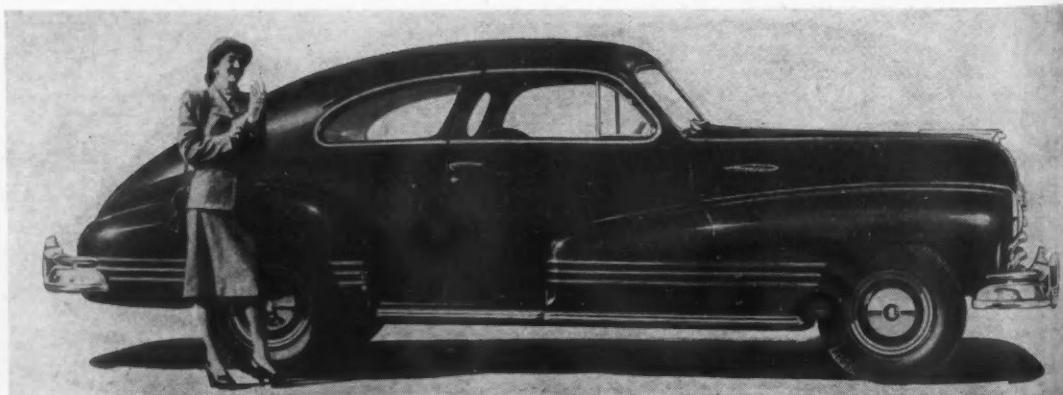
Changes in G.M. Prices

Retail Prices in Detroit Before Taxes and with Standard Equipment

	Old Price	New Price
Buick		
56 Conv. Coupe	\$2327.33	\$2477.33
76 Conc. Coupe	2638.95	2798.95
Cadillac		
62 Conv. Coupe	2417.00	2567.00
Oldsmobile		
66 Conv. Coupe	1668.00	1742.00
98 Conv. Coupe	2026.00	2181.00
66 Station Wagon	2201.00	2319.00
Pontiac		
Torpedo 6		
Sedan Coupe	1404.00	1410.00
Business Coupe	1312.00	1318.00
Sport Coupe	1358.00	1364.00
Conv. Coupe	1636.00	1718.00
2-Door	1373.00	1379.00
4-Door	1432.00	1438.00
Torpedo 8		
4-Door	1460.00	1485.00
2-Door	1400.00	1426.00
Sedan Coupe	1433.00	1457.00
Business Coupe	1340.00	1365.00
Conv. Coupe	1663.00	1763.00
Sport Coupe	1386.00	1411.00
Streamliner 6		
Sedan Coupe	1443.00	1468.00
4-Door	1515.00	1519.00
Station Wagon Std.	1947.00	2135.00
Station Wagon DeL.	2024.00	2212.00
Streamliner 8		
4-Door	1543.00	1566.00
Sedan Coupe	1473.00	1516.00
Station Wagon Std.	1975.00	2182.00
Station Wagon DeL.	2052.00	2259.00

1947 Pontiac

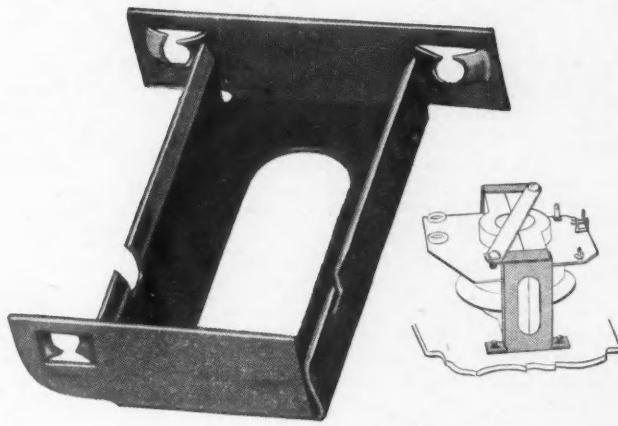
Pontiac again offers two series of cars—the Streamliner and Torpedo, with a choice of six or eight cylinder engines. Changes for 1947 have been confined to appearance and design refinements. Plant expansion will provide for production of a quarter million of the new models.



This is a SPEED NUT.....



and



THIS is also a Speed Nut!

Of course you recognize the Standard SPEED NUT shown above, but just look at the "nightmare" our development engineers dreamed up, to provide multiple fastening and operational functions in a single unit! It is used in the assembly and mounting of television transformers (see sketch) and you can readily understand its advantages over special mounting brackets and individual, hard-to-handle threaded nuts and lock washers.

In addition to the widely-used standard types of SPEED NUTS, hundreds more are functionally designed to combine assembly operations, eliminate unnecessary handling of parts, speed-up production and thereby reduce final costs. They

are fabricated on specially designed, automatic machines which produce *completely finished* parts at high speeds.

There must be some step in the assembly of your product where, by changing over to SPEED NUTS, your costs could be reduced and your product improved. Why not send us your assembly details, or better still, send in the parts involved. We will be glad to give you a complete fastening analysis . . . at no cost.

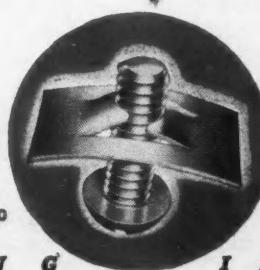
TINNERMAN PRODUCTS, INC.
2059 FULTON ROAD • CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ont.
In England: Simmonds Aerocessories, Ltd., London
In France: Aerocessaires Simmonds, S. A., Paris
In Australia: Aerocessories, Pty., Ltd., Melbourne

Speed

MORE THAN 4000

P A S T E S T T H I N G I N F A S T E N I N G S



Nut*
PATENTED

SHAPES AND SIZES

* Trade Mark Reg. U. S. Pat. Off.

CALENDAR

Conventions and Meetings

New York Aviation Show, Grand Central Palace, New York City....Feb. 1-8	
Amer. Soc. for Testing Materials—Spring Mtg. Phila.Feb. 24-28	
Amer. Soc. of Mechanical Engineers—Spring Mtg., Tulsa.....Mar. 2-5	
Amer. Soc. of Lubrication Engineers—Annual Convention, Pittsburgh, Mar. 17-19	
Amer. Soc. of Tool Engineers—Fifteenth Annual Convention — Houston, TexasMar. 19-22	
Amer. Soc. for Metals, San Francisco, Mar. 22-27	
Midwest Power Conference, Chicago, Mar. 31-Apr. 2	
Nat'l Assoc. Corrosion Engineers, National Convention, Chicago...April 7-10	
Soc. of Automotive Engineers, Aero-nautic Mtg., New York.....April 9-11	
Soc. of Automotive Engineers, Transportation Mtg., Chicago.....April 16-18	
Chamber of Commerce of the United States, Annual Mtg., Washington, D. C.Apr. 23-May 1	
Amer. Foundrymen's Association, Annual Convention, Detroit..Apr. 28-May 1	
Soc. of Automotive Engineers, Personal Airplane Mtg., Wichita, Kansas, May 1-2	
Soc. for Experimental Stress Analysis Annual Mtg., ChicagoMay 15-17	
Nat'l Assoc. of Motor Bus Operators Annual Mtg., ChicagoMay 21-23	
Amer. Soc. of Mechanical Engineers—Oil & Gas Power Nat'l Conference—ClevelandMay 21-24	
Amer. Soc. of Mechanical Engineers—Aviation Mtg., Los Angeles..May 26-29	
Soc. of Automotive Engineers—Summer Mtg. French Lick Springs, Ind..June 1-6	
Amer. Soc. of Mechanical Engineers—Semi-Annual Mtg., Chicago ..June 16-19	
Amer. Soc. for Testing Materials—Annual Mtg., Atlantic City.....June 16-20	
Soc. of Automotive Engineers—West Coast Transportation & Maintenance Mtg., Los Angeles....Aug. 21-23	

1946 Truck Trailer Production*

Type of Trailer	November	Eleven Months
Vans		
Insulated.....	112	1,088
Refrigerated.....	227	2,154
Furniture.....	48	1,682
All other closed top.....	2,535	24,549
Open top.....	225	1,747
Total Vans.....	3,147	31,190
Racks		
Cattle Racks.....	809	4,495
Stake Racks.....	256	3,049
Total Racks.....	865	7,544
Tanks		
Petroleum.....	188	1,676
Other.....	101	702
Total Tanks.....	289	2,378
Pole and Logging		
Single Axle.....	638	5,616
Tandem Axle.....	223	1,449
Total.....	861	7,065
Platforms.		
Low-bed haulers (over 15 ton)....	1,206	10,626
Off-highway.....	229	1,829
Dump Trailers.....	54	532
All other Trailers.....	79	651
Total—All Trailers.....	261	2,298
Trailer Chassis.....	396	5,235
Total—Trailers and Chassis... .	7,449	69,348

* Industry Division—Bureau of the Census.

First National Materials Handling Exposition

The first exposition to deal entirely with industry's materials handling problems, a phase of industry which represents approximately one quarter of all labor costs, was held at the Public Auditorium, Cleveland, Ohio, Jan. 14 through 17. The first National Materials Handling Exposition attracted a registered attendance of 8000 users and potential buyers of handling equipment.

A four-day concurrent program of panel discussion on handling problems was conducted by 40 specialists representing many different industries.

Hoists, hoist mountings, cranes, derricks, conveyors, hand and power trucks, skids and pallets, tractors, and trailers were displayed by 113 manufacturers, and the various types of equipment, with several models of each, were demonstrated in a simulated warehousing operation conducted under the auspices of the American Warehousemen's Assn.

Tentative arrangements have been made to hold a second similar exposition Jan. 13-16, 1948, probably also at Cleveland.

Mr. Tucker Tells About His Car

(Continued from page 50)

per dealer throughout the country is estimated at approximately 100 per year.

This means that a dealer with potential sales of 100 cars per year will pay \$4,000 for the two year franchise, which can be renewed at the end of the period by agreement between the dealer and the company without further payment. The contract also provides for refunds in event of price reductions, and rebates on automobiles in stock when models change.

Distributors pay for their retail dealer franchise on the same basis as dealers but the contract is for a five-year period. The distributor gets the same retail discount, plus the standard over-ride on wholesale sales.

In the beginnings of this enterprise the Tucker organization publicized some pretty early dates for the start of production. Whether or not these dates could have been met, the entire program has been set back at least three months by the imposition of the now defunct NHA directive. However, Tucker feels this set-back was really a blessing in disguise since the resulting publicity and fanfare have made the enterprise known to millions of people.

Claire Leroy Barnes

Claire Leroy Barnes, 66, president of Bendix Helicopter, Inc., and founder and director of the Houdaille-Hershey Corp., died Jan. 17 at New York City.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE and AVIATION INDUSTRIES

Narrow fluctuations in general business activity are indicated. The *New York Times* index for the week ended Jan. 11 stands at 147.6, as against 148.0 for the preceding week and 132.9 a year ago.

Sales of department stores during the week ended Jan. 11, as reported by the Federal Reserve Board, equaled 233 per cent of the 1935-39 average, as compared with 187 per cent in the week before. Sales were 24 per cent above the corresponding distribution a year earlier, as against a preceding similar excess of 38 per cent. The total in 1947 so far reported is 23 per cent greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended Jan. 11. The output was 12.7 per cent above the corresponding amount in 1946, as compared with a like advance of 13.2 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 830,945 cars, 20.9 per cent more than the figure for the week before and 7.5 per cent above the corresponding number in the preceding year.

Crude oil production in the week ended Jan. 11 averaged 4,530,900 barrels daily, 117,850 barrels less than the preceding average and 39,850 barrels below the comparable output in 1945.

Production of bituminous coal and lignite during the week ended Jan. 4 is estimated at 11,350,000 net tons, 23 per cent above the output in the week before. The total production reported for the calendar year 1946 is 532,000,000 net tons, or 7.9 per cent less than the corresponding quantity in 1945.

Civil engineering construction volume reported for the week ended Jan. 16, according to *Engineering News-Record*, is \$110,241,000, or 22 per cent above the preceding weekly figure and 143 per cent above the comparable sum in 1946. The total recorded for three weeks of this year is 49 per cent more than the corresponding amount in 1946. The increase in private construction is 49 per cent, and the rise in public construction is 48 per cent.

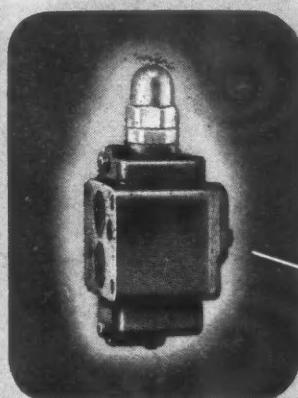
The wholesale price index of the Bureau of Labor Statistics for the week ended Jan. 11 is 140.0 per cent of the 1926 average, as compared with 139.1 for the preceding week and 106.7 a year earlier.

Member bank reserve balances decreased \$26,000,000 during the week ended Jan. 15. Underlying changes thus reflected include a decline of \$270,000,000 in Reserve bank credit and an increase of \$8,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a reduction of \$230,000,000 in money in circulation.

Total loans and investments of reporting member banks decreased \$522,000,000 during the week ended Jan. 8. A decline of \$29,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$10,222,000,000, shows a net increase of \$2,980,000,000 in twelve months.

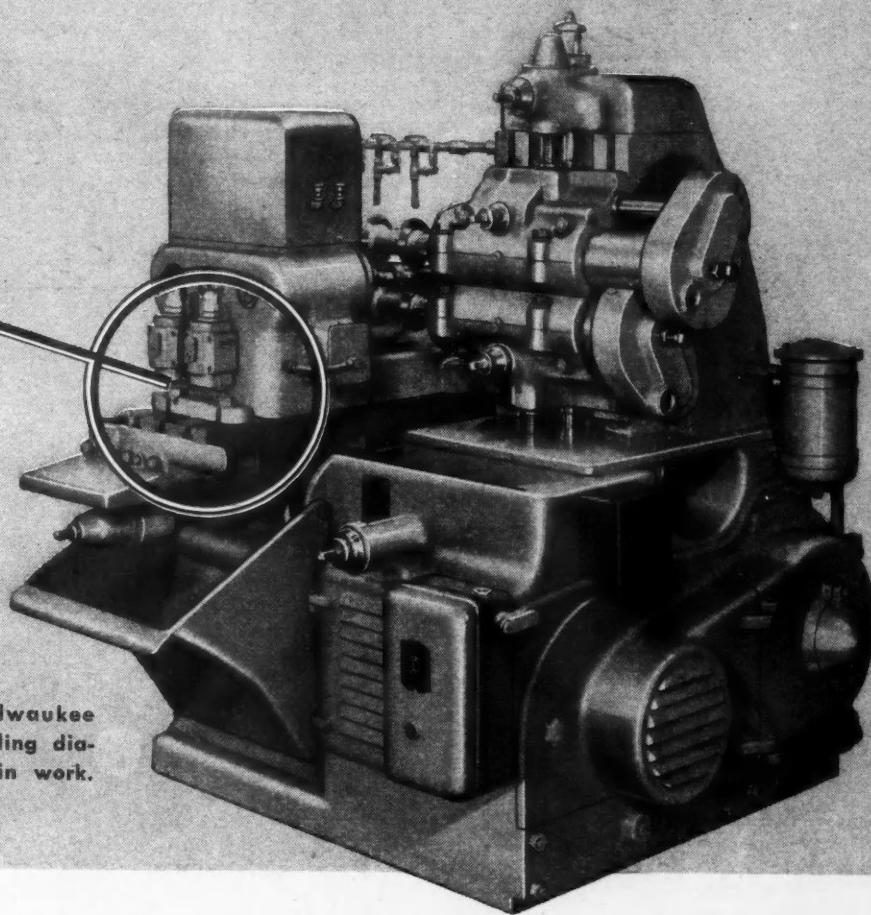
VICKERS HYDRAULIC CONTROLS

*Simplify Machine Operation...
Protect Work and Machine*



Vickers Hydraulic Sequence
and Check Valve.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.



Kearney & Trecker Milwaukee Simplex for multiple milling diametrically opposite slots in work.

This is a representative installation of Vickers Hydraulic Controls featuring interlocking of machine operating phases by a combination of pilot interlocks and pressure sequence control valving. Three work arbors are indexed to position for simultaneous slot milling . . . accurate register and timing being assured by series connected pilot and pressure sequence interlocks. Thus all three pieces are in proper position before cutters approach the work. The

same positive interlocking prevents succeeding automatic index until cutters are clear.

Other advantages of these valves: (1) they automatically provide "cushioned" operation, and (2) their ease of adjustment saves set up time when a variety of types of work is to be accommodated.

Our application engineers will be glad to discuss adaptations of Vickers Hydraulic Controls to your products.



2346
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

VICKERS Incorporated

1428 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WORCESTER

New Products Disclosed By Boat and Engine Manufacturers

For many years the annual National Motor Boat Shows have been regarded as infallible barometers for the industry and sport in the particular year lying ahead. Basing their estimates on the 37th Annual Show, held Jan. 10 to 18 in Grand Central Palace, New York, after a lapse of six years, boat and engine builders and other manufacturers in the realm of recreational boating were able to agree that 1947 will prove to be their most prosperous year, with materials scarcity and physical limitations on production facilities the only hurdles to overcome in turning out the greatest number of boats, marine engines and nautical accessories ever recorded in any 12-month period.

The record-breaking throngs, representing a gain in paid attendance of 152 per cent over the 1941 show, not only revealed the tremendous public interest in recreation afloat, but were responsible for a sales volume, for the show period alone, that is expected to exceed \$10 million. Practically all of the 227 exhibiting manufacturers state that their entire production for 1947 has been earmarked for dealers and individual purchasers.

The 1947 Show presented the great strides in boat construction development and materials used.

The greatest opposition to conventionality has been the widespread adoption of molded, plastic-reinforced plywood. From cruiser builders to dinghy producers, many exhibitors were using plywood as their prime material.

Prior to the war, when small boat buyers wouldn't be thwarted from lap-strake and planked type craft, as large a producer as United States Plywood Corp. sold only 1400 molded boat shapes. Since Aug. 5, 1946, they have manufactured 7250 "Weldwood" boat shapes for outboards, dinghies, and sailboats.

The tremendous output of aluminum

for war use, found large users, i.e., aircraft manufacturers, and basic producers, scurrying at the war's end to find new uses. The recreational boating industry was to their order. A large scale example of their production and merchandising efficacy was to be found at the Boat Show.

Although 1946 was productionally inconsistent, Grumman, well known builder of Naval aircraft, produced 10,000 aluminum canoes. Now at the Boat Show they introduced an eight ft, six in. dinghy.

Douglas Aircraft Co. of Santa Monica, Calif., and Reynolds Metals Co., Marine Division, have both produced aluminum craft that were popular at the Show, both of which need no painting, caulking or scraping.

Magnesium boats which claim greater strength and lighter weight than any other metal, made an exhibition debut at this Boat Show.

With almost 50 Diesel and gasoline inboard and outboard engine displays on the four exhibition floors of Grand Central Palace, the power plant companies have greater representation than at any previous National Motor Boat Show.

The power gamut runs from Evinrude's 1.1 hp Ranger outboard motor to the Cleveland Diesel lightweight 1200 hp engine. Between these two extremes range the wares of 10 Diesel engine builders and 34 gasoline inboard and outboard motor producers.

Emphasis for years has been on weight per hp. Through the war numerous refinements and the use of lighter weight materials have succeeded in making considerable advancements. Detroit Diesel Division of General Motors has saved 40 per cent in weight and 50 per cent in size through the use of a new GM hydraulically operated reverse and reduction gear.

Another advancement in alloy de-

velopment has been in corrosion resistance. The materials from which blocks and cylinder heads are cast have undergone improvements contributing to longevity and more efficient operation.

Fourteen engines, 12 gasoline and two Diesel, were exhibited by Gray Marine Motor Co. Gray has brought out seven new models for 1947. The three additions to the gasoline line are the Lugger Six-247, rated at 115 hp at 2400 rpm, the Express Six-247, a higher speed version which, with changes in manifold, carburetion, compression ratio and camshaft, develops 150 hp at 3200 rpm, and a two-carburetor Super-Six 247 which pulls 170 hp at the same speed.

The new Diesels are the first of a series based upon the design originated by the Continental Motors Corp. They are of the four-cycle, high-speed type and the models are 35, 55, 85 and 150 hp. All are valve-in-head motors built along conventional lines, but with a new combustion chamber which is said to absorb peak pressures during combustion and reduces working loads on pistons, bearings and crankshaft.

Nordberg Manufacturing Co. introduced a line of six-cylinder, L-head gasoline engines in three models. The Model 230 high duty develops 88 hp at 3000 rpm, Model 320 medium duty develops 102 hp at 2400 rpm, and Model 340 high duty has an output of 133 hp at 3000 rpm. A six-cylinder, 9 by 11½ cu-in. Diesel engine which typifies the company's products in the heavy duty, medium speed field, was on display.

The Buda Co. had on display three new marine Diesel engines, the Model 6-BDMR-230, a six-cylinder engine with a displacement of 230 cu in.; the Model 8-DCMR-1125, an eight with a cu in. displacement of 1125; and the Model 6-DCMR-844, a six with a displacement of 844 cu in.

The Marine Division of Chrysler Corp. displayed six of the engines included in its "Twentieth Anniversary Line." The new line has two sixes and

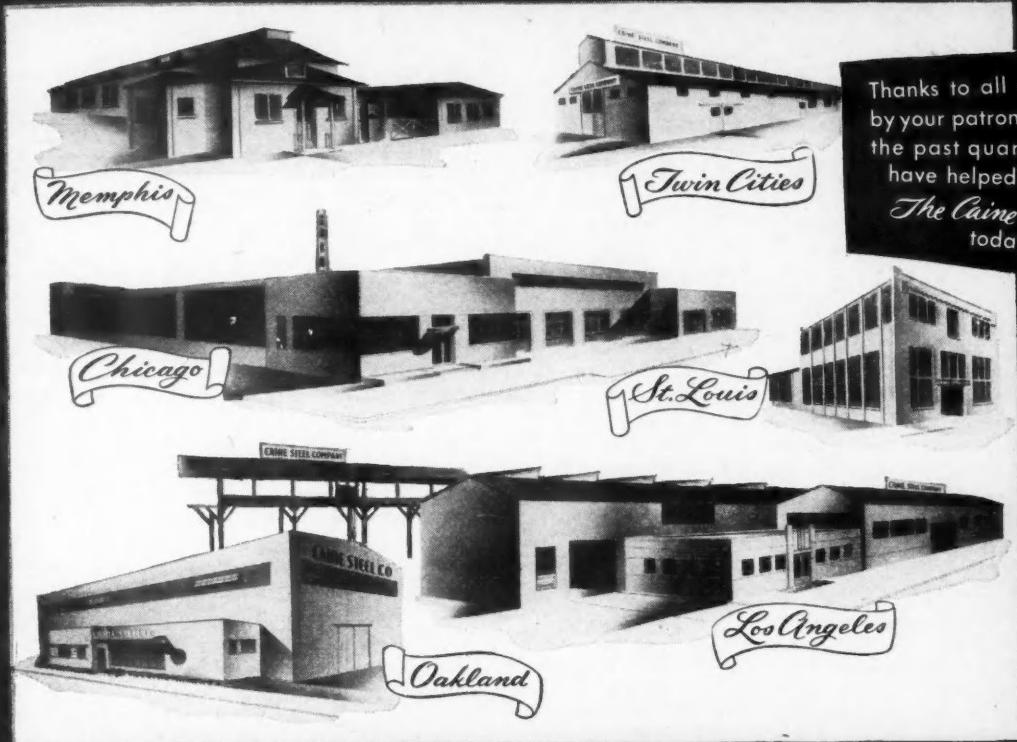
(Turn to page 58, please)

1947 Buick

A new wing-tip grille, a system of mounting body to frame in which all metal-to-metal contacts are eliminated, and numerous minor mechanical improvements are the principal features of the Buick line for 1947. Production in three series and nine body styles began with an initial output of 1100 units daily.



25 Years Young



Thanks to all of you who,
by your patronage through
the past quarter century,
have helped make this
The Caine Picture
today!

and Still Growing

**The Record of the Years Gives Assurance
of Continued Growth for Finest Service**

Serving steel users to THEIR profit . . . is responsible for the CAINE PICTURE as it is today. We feel it is a most fitting celebration of our twenty-fifth year to continue and to accelerate our program aimed toward making it increasingly profitable for you to call on Caine for Specialized Warehouse Service.

1922 * 1947
TWENTY-FIFTH ANNIVERSARY YEAR

WAREHOUSES at Chicago, St. Louis, Minneapolis, Los Angeles, Oakland
OFFICES at Kansas City, Grand Rapids, Forging Plant at Memphis

CAINE Steel Company

in Sheets, Strip and Flat Wire

an eight with the flywheel aft and two sixes and an eight with the flywheel forward. The engines are available in horsepower ranging from 92 to 141 and with a wide variety of reduction gears.

The exhibit of the Atlas Imperial Diesel Engine Co. centered on a completely equipped six-cylinder, 6½ in. by 8½ in., 135-hp marine engine.

This power plant is fitted with Snow Nabstedt reverse and reduction gear, fresh water cooling system, Bosch APF fuel system, Twin Disc forward power take off clutch, and a power take-off sheave mounted on the forward end of the crankshaft behind the clutch.

A 12-cylinder, two-stroke, 1200-hp lightweight Diesel engine designed and built for commercial service, was displayed by the Cleveland Diesel Engine Division of General Motors.

This unit, of steel-type construction employing the unit injection system and uniflow scavenging, represents a line comprising six, eight, 12 and 16-cylinder engines.

A cutaway version of the fuel system used exclusively in its motors complements the Cummins Engine Company's exhibition of three marine Diesel engines.

The HMR-603 Model, one of the three engines shown, rates up to 93 horsepower at 1600 rpm for continuous heavy duty service.

A supercharged Model NHMS-604, which rates up to 175 hp at 1800 rpm and a Model LML-602, rated for continuous heavy duty marine service at 177 hp at 800 rpm completed the exhibit.

Caterpillar Tractor Company's contribution to the engine exhibit consisted of its D4600 marine engine complete with standard starting motor, Joe's 3-to-1 reverse and reduction gear, remote control, flexible fuel lines, side exhaust elbow outlet, front power take-off and a 32-volt, 750-watt generator.

This six-cylinder, four-stroke cycle, valve-in-head engine develops 65 hp in continuous sustained service at 1500 rpm.

The Detroit Diesel Engine Division of General Motors display of 12 engine models from the two-cylinder 55-hp engine to the 12-cylinder, twin six machines, was set up in replica in the factory showroom in December.

All GM Diesel marine propulsion units in the exhibit, except the two-cylinder models, were equipped with the newly-developed General Motors hydraulically operated reverse and reduction gears. This assembly is built as an integral part of the engine and utilizes part of the weight and space occupied by the previous engine flywheel. The result is a saving in weight up to 40 per cent and in size up to 50 per cent over previous gears. Clutches are manipulated hydraulically so that the gear is shifted through a four-in. lever requiring the light pressure of about 10 lb-in.

The Hall-Scott Motor Car Company's exhibit comprised one V-12 Defender

and three different models of the familiar Invader.

The Defender is a 12-cylinder, 5¾-in. bore, 7-in. stroke engine developing 600 hp at 2100 rpm. The Invader, a six-cylinder, 5½-in. bore, 7-in. stroke engine develops 250 to 275 hp at 2100 rpm. Like the larger Defender, it is available in direct or reduction gear drive.

Kermath Manufacturing Co., Detroit, Mich., had a comprehensive display of seven gasoline engines ranging from the four-cylinder, 25-hp Sea Cub to the 550-hp V-12 Sea Raider, and three medium-duty Diesel engines. The Diesels are a 55-65 hp medium duty four of 226 cu-in. displacement available with either direct drive or reduction gear; a 298 cu-in., 84-hp six; and a six-cylinder, 113-hp medium heavy duty engine of 474 cu-in. displacement.

The Lathrop Engine Co. exhibited a four-cylinder, 50-hp Diesel, a type 125 Mystic model, an LH-D6 deluxe motor with 2:1 reduction gear, an LH-4 model with direct drive and one LH-4 engine with 2:1 reduction gear.

For 1947, Lathrop's line of light, medium and heavy duty gasoline engines will cover a range of 20 to 175 hp. The Diesels will be the D-50 four-cylinder motor and the six-cylinder D-80.

Palmer Brothers Engines, Inc., displayed several of its high speed series of four and six cylinder models that covers units of 25, 45, 75 and 120 hp, the heavy duty series, that includes one, two, three and four cylinder engines rating from seven to 40 hp and Diesels in one, four and six cylinder models of nine to 125 hp.

The Scripps Motor Co. showed a number of engines in its line that ranges from four to 12 cylinder gasoline engines and is rounded out by four and six cylinder Diesels. Starting with a four-cylinder, 134 cu-in. piston dis-

placement model in Series 30, the Scripps gasoline line runs through a series of light, high-speed models in the six cylinder, V-8 and V-12 designs up to 130 hp.

The higher power output range begins with the six-cylinder 150 Series, which develops 169 hp at 3000 rpm and includes the V-12 300 Series engines which pull 316 hp at 2600 rpm.

Sterling Engine Co. displayed two variations of the company's six cylinder, 250-hp Petrel gasoline engine and five Diesel engines, three of which formerly were manufactured by the Superior Engine Division of the National Supply Co.

The Diesel section of the exhibit comprised a four cylinder, 366 cu-in. 30-hp model; a six cylinder, 549 cu-in. 110-hp unit; and an eight cylinder, 1330 cu-in. 230-hp engine, all former Superior products, and Sterling's Viking six and eight cylinder engines, the latter equipped with supercharger.

The Universal Motor Co. exhibited its full line of engines and electric power plants. Universal's line of 10 gasoline engines range from eight to 141 hp and one to eight cylinders.

Two builders of air-cooled engines brought their products to the show. D. W. Onan & Sons, Inc., showed a 100-lb, four-cycle, twin-cylinder opposed engine, and the United States Motor Corp. displayed 1¾, 2¼, 3¼ and seven hp units in addition to its two new two-cylinder water-cooled engines, one of which develops 10 hp and the other 15 hp.

Advertising Note

Service Station Equipment Co., Muskegon, Mich., is planning an expanded sales promotion and advertising program for 1947, and has announced the appointment of Behel and Waldie and Briggs, Inc., Chicago, to direct their advertising account.

New Truck Registrations*

November and Eleven Months 1946 Compared with 1941

MAKE	October 1946	September 1946	October 1941	Ten Months		Per Cent of Total Ten Months	
				1946	1941	1946	1941
Chevrolet.....	23,272	21,079	13,947	129,337	187,403	26.31	33.29
Ford.....	17,732	15,790	7,916	102,800	151,331	20.91	26.88
Dodge.....	7,962	8,115	5,102	79,289	54,351	16.12	9.66
International.....	9,258	8,425	6,550	64,386	82,701	13.09	14.69
Willys.....	5,201	4,988	130	34,915	1,755	7.10	.31
Studebaker.....	2,874	3,198	496	19,970	4,433	4.06	.79
G.M.C.....	3,356	3,755	3,573	17,792	39,959	3.62	7.11
Reo.....	1,227	1,154	183	8,103	1,335	1.85	.24
White.....	1,125	665	807	7,780	8,146	1.58	1.46
Mack.....	108	110	1,031	4,382	8,607	.89	1.51
Diamond T.....	560	340	475	3,930	5,363	.80	.95
Federal.....	367	454	150	3,662	1,350	.74	.24
Autocar.....	444	318	221	3,645	2,193	.74	.39
Divco.....	392	260	181	3,052	2,016	.62	.36
Brockway.....	313	284	213	3,014	1,969	.61	.35
Hudson.....	178	279	31	2,120	668	.43	.12
F.W.D.....	48	46	16	455	238	.09	.04
Sterling.....	48	44	25	436	358	.09	.06
Plymouth.....	6	2	199	22	7,555	1.34
All Others.....	237	233	138	2,728	1,241	.55	.22
Total.....	74,708	69,565	41,352	491,818	562,892	100.00	100.00

*Data from R. L. Polk & Co.

POWER



WHEN EXIDES DO THE CRANKING THE HUSKIEST DIESELS START...

Diesel cranking is not tough for an Exide. The high cranking power of Exide Batteries is being demonstrated daily on all types of Diesel powered equipment both on and off the highway and in all climates.

Exide Batteries have ample reserve power—the ability to discharge at high rates and at high voltage. Their rugged construction keeps them steadily on the job. Whatever or wherever the job, you can count on Exide Batteries for dependability, long-life and ease of maintenance.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

IHC Establishes New Pricing Policy

(Continued from page 19)

ments in this group are: the adoption of aluminum pistons on the 214 and 233 cu in. engines, leading to an increase in power output and performance as well as smoother operation; wide base rims on the KB-5; steering column gear-shift for three-speed transmissions on the five light-duty models; larger diameter steering-wheels; propeller shaft with "CR" type joint. All of the six models have roller-bearings, anti-friction universal joints, three-point rubber engine mounting, rubber-mounted radiators, tilt-ray sealed-beam headlamps, oil-bath air cleaners, and truck-type clutches and transmissions.

The following features are common to the KB-1, KB-2, and KB-3 only: under-cowl hand-brake lever; relocated accelerator pedal; addition of propeller-shaft brake. Increased cab room, insulated cab design, and use of a combination light switch and thermostatic circuit breaker are features of these three models as well as the KB-5.

It may be noted that the KB-1-M and KB-3-M are special chassis types for all-steel delivery bodies used for multi-stop distribution of light but bulky loads.

Front-end sheet metal is an integral assembly with the grille, forming an easily removable one-piece unit to provide maximum accessibility for engine maintenance operations. Two-shoe, double anchor-type hydraulic brakes are found in the light models while the "Hi-Tork" brake is used in the KB-5. The two-speed axle offered optionally on the latter model employs vacuum shift.

The nine heavy-duty models in the "KB" line, all produced in the Fort Wayne plant, with their gross vehicle weight ratings (which of course depend upon the type of operation, loads, speeds and grades encountered) are:

KB-6	(4-wheel).....	14,500-18,800
KB-6-F	(6-wheel).....	22,000-28,600
KB-7	(4-wheel).....	16,500-21,500
KB-8	(4-wheel).....	20,000-26,000
KB-8-F	(6-wheel).....	27,000-35,100
KB-10	(4-wheel).....	22,500-29,250
KBR-11	(4-wheel).....	27,000-35,100
KBR-11-F	(6-wheel).....	37,000-48,100
KBR-12	(4-wheel).....	28,500-35,100

Models KB-6 and KB-7 are available in four wheelbases: 134, 146, 158 and 176 in.; KB-8 in five wheelbases: 137, 149, 161, 179 and 197 in.; KB-10 and KBR-11 in four wheelbases: 149, 161, 179 and 197 in. The KBR-12, designed especially for high-speed cross-country truck-tractor service, is available only in 161 in. wheelbase. The six-wheel models (all driven on the 4 rear wheels—6 by 4 type) are also available in a wide variety of wheelbase lengths, as follows: KB-6-F in three wheelbases: 151, 176 and 194 in.; the KB-8-F in four wheelbases: 161, 179, 197 and 215 in.; the KB-11-F in three wheelbases: 161, 197 and 215 in.

The nine heavy-duty basic models are powered by five sizes of six-cylinder, valve-in-head, replaceable-dry-sleeve type engines, ranging in size from a 250 cu in. engine developing 99.8 hp at 3200 rpm to a 586 cu in. engine developing 200 hp at 2600 rpm. Torques range from 200.5 to 475 lb ft.

The KB-6 is powered by the International Blue Diamond 250 engine; the KB-6-F and KB-7 by the Blue Diamond 269; the KB-8 by the Red Diamond 361; the KB-8-F and the KB-10 by the Red Diamond 401; the KBR-11 and the KBR-11-F by the Red Diamond 450; and the KBR-12 by the International-Continental S-6586. The Blue Diamond series for the KB-6, KB-7, and KB-6-F have an improved Tocco-hardened cam-shaft, increased piston displacement, improved carburetor, and a new crank-shaft with increased main bearing line diameter. The Red Diamond engines for the remaining models, except the Continental engine on the KBR-12, feature improved Tocco-hardened cam-shaft, higher compression-ratio, adoption of the Thompson Products "U-Flex" oil ring, Cleveland Graphite "77" main and connecting rod bearings, duplex carburetion, and a vacuum-mechanical governor as standard equipment.

A variety of four and five-speed transmissions, auxiliary transmissions and bevel-gear double-reduction and dual-ratio rear axles is provided for all heavy-duty models. Common also to these models are: wide base rims; increased cab room; insulated cab; combination light switch and thermostatic circuit breaker; oil filled ignition coil on all except the KBR-12. New common colored cable and stamped circuit numbers is a feature of the entire line.

On the KB-8 through the KB-11-F, IHC has either new or improved axles featuring details which contribute to higher ratings and improved service life. On the KB-6 through the KB-10, the Bendix Hydrovac brake system replaces the booster cylinder used previously. An increased capacity standard transmission is found on the KB-6. Vacuum shift for two-speed axles is offered on the KB-6, KB-7, KB-8, KB-10, and KBR-11. A two-speed axle of increased capacity is found on the KB-7 and KB-8.

Styling of the nine heavy-duty models conforms to that of the lighter models but provides more massive appearance in keeping with vehicle size. The all-steel cabs have ample leg room and foam-rubber seat cushions.

The other six models that complete the new International line are the recently introduced "W" or "Western" models, built at the Emeryville, Calif., plant. Two of these, W-3042-H (4-wheel) and W-4064-H (6-wheel), are

highway models with gross vehicle weight ratings of 30,000 and 40,000 lb respectively. Four are off-highway models, the W-4042-OH (4-wheel), and the W-4564-OH, W-6564-OH and W-9064-OH (6-wheel) with gross vehicle weight ratings of 40,000; 45,000; 65,000; and 90,000 lb respectively. All six of these basic "W" Models are available with five engine options, three diesel and two for gasoline or butane fuel, as follows:

1. Standard: International-Continental S-6749 gasoline engine of 749 cu in. displacement, developing 254 hp and 585 lb-ft of torque.

2. Optional: Hall-Scott HS-400 gasoline engine of 1090 cu in. displacement, developing 295 hp and 938 lb-ft of torque.

3. Optional: Cummins Diesel HB-600 of 672 cu in. displacement, developing 150 hp and 492 lb-ft of torque.

4. Optional: Cummins Diesel NHB-600 of 743 cu in. displacement, developing 200 hp and 535 lb-ft of torque.

5. Optional: Cummins Supercharged Diesel NHBS-600 of 743 cu in. displacement, developing 275 hp and 710 lb-ft of torque.

A choice of eight heavy-duty transmissions of four or five speeds; and a group of four, three-speed auxiliary transmissions of either direct or overdrive type is available to meet operating conditions. In combination with these, IHC offers a variety of double-reduction and dual-ratio final drives.

Cabs for the "W" models provide unusual visibility with easy to reach controls. Cabs are rubber-cushioned against noise, vibration, road shock, and distortion. The adjustable driver's seat has foam-rubber cushions. Standard cab equipment includes: hot water heater, ventilating system and defroster.

Three Billion Parts Year

(Continued from page 17)

be produced; if 4,000,000 new vehicles are produced in 1947 and no additional raw material is available, 87 per cent of the estimated replacement parts requirements can be produced.

The sales volumes used in all of these estimates are on the basis of 1941 parts prices. As a result of increased prices for both original equipment and replacement parts, the actual dollar volume of the parts industry at manufacturer's prices should be well over \$3,000,000,000 for 1947.

IAS Appoints Jas. L. Straight

The Institute of the Aeronautical Sciences has appointed James L. Straight, Wartime Committee Coordinator for the Aircraft War Production Council, West Coast, as manager, Western Region.

The CONE AUTOMATIC MACHINE COMPANY

 sees many
GOOD THINGS AHEAD

It is reported that

Westinghouse calls its new steel encased motor the most revolutionary change in construction in 58 years and states that it delivers up to 134% more power per pound than previous motors.

get ready with CONE for tomorrow

Federal Telephone and Radio Corporation will conduct experiments with television, FM and radar in a building at Nutley, N.J., which will be completely shielded from atmospheric electricity.

be ready with CONE for today

Called the world's largest, a spot welder that can make 48 welds at a single stroke is in use at Pullman-Standard Car Manufacturing Co.

get ready with CONE for tomorrow

A division of Reynolds Metals Company has a new line of all-aluminum bicycles and scooters.

be ready with CONE for today

Raytheon Mfg. Co. has an electronic kitchen range. The food is put in a disposable dish and quickly cooked by the energy from a magnetron tube.

get ready with CONE for tomorrow

Bell Telephone Laboratories report that they have developed a tube that will send a hundred million words per minute by telegraph.

be ready with CONE for today

The Army Air Force has contracted with Fairchild Engine and Airplane Co. for fundamental research in the use of atomic energy in aircraft.

get ready with CONE for tomorrow

Aluminum Co. of America has recently supplied a 100-foot all-aluminum span for a railroad bridge at Massena, New York.

The behavior of piston rings and oil films has been studied by the National Advisory Committee for Aeronautics by using a glass engine cylinder.

get ready with CONE for tomorrow

When their new 2-million volt machine is installed, Babcock and Wilcox Co. will have 12 X-ray machines in use for checking steam generating equipment.

be ready with CONE for today

The Souhegan Mills of Wilton, N. H., believes that its molded board, made of shavings, can compete in price and utility with plywood or lumber.

be ready with CONE for today

The U. S. Bureau of Mines finds that Freon II is more effective in fighting gasoline fires than any of the other gases tested.

get ready with CONE for tomorrow

Patent 2,404,206 has been granted for a method of mining practically pure copper by dissolving it chemically and accumulating it electrolytically.

be ready with CONE for today

Nylon drive ropes are said by Plymouth Cordage Company to reduce machine shut-downs.

be ready with CONE for today

Blaw-Knox has built two 23-cubic yard clamshell buckets for unloading coal on Lake Superior. They weigh nearly 14 tons apiece and are believed to be the largest of their kind.

get ready with CONE for tomorrow

Scientific American prophesies that the use of silicones will bring about a revolution in surface finishes comparable to that resulting from the development of nitro-cellulose lacquers.

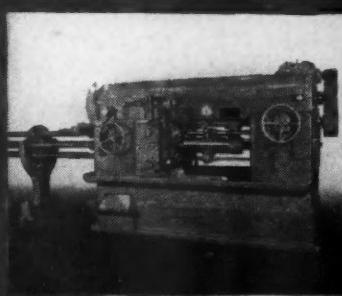
FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

**Give soft jobs to
any Automatic**



put the tough ones on a CONE

From 65 mm 3312 stock, a 2½" Six Spindle Conomatic, with 13 HSS tools, produces the part shown here in 71 seconds.



*Ask your CONE representa-
tive to show you our new
color motion picture*

CONE

AUTOMATIC MACHINE CO., INC. • WINDSOR, VERMONT, U.S.A.

First Unitized Transfer Line

(Continued from page 27)

(5) 5/6 x 18 valve cover holes, (1) 5/16 x 18 cable clamp hole.

Twelfth Station—Unload.

The work then is washed and blown off in the Detrex washing machine built into the line, and is assembled with bearing caps on the conveyor.

It then goes into the Greenlee automatic line transfer machine for semi-finish- and finish-boring of camshaft and crankshaft bearing seats, straddle-milling of the center main-bearing seat, and boring of the oil deflector and packing grooves. This machine has seven double stations, each station holding two blocks so as to speed its output. Blocks are loaded with pan rail up in the first station. The second station on the left side semi-finish-bores the cam-shaft bearing seats while the right side semi-finish-bores the crankshaft bearing seats. The third station is idle. The fourth station on the left straddle-mills the center main bearing while the right station finish-bores the oil deflector and packing grooves. The fifth station is idle. At the sixth station, the left head finish-bores the camshaft line while the right head finish-bores the crankshaft bearings. Work is unloaded with pan rail up in the seventh station.

Valve lifter bores are finished in two operations in Footburt multiple-spindle drills fitted with hydraulically operated automatic three-station fixtures. The first machine semi-finish-bores while the second finish-reams.

It will be recalled that the cylinder bores were rough-bored at the second operation. Now they are semi-finish-bored in another of the new eight-spindle vertical Ingersoll boring machines, fitted with a three-station automatic fixture for loading, boring, and unloading.

We come now to the battery of six, eight-spindle Ex-Cell-O vertical type precision boring machines which were developed specifically for Buick. In their present improved form these machines produce a bore of exceptional quality as to surface finish and dimensional tolerances. Roundness of the bore is an important characteristic from the standpoint of engineering. The bores come out with a maximum variation of 0.0005 in. for taper and out-of-round, really an exceptional accomplishment in mass production. The machine is provided with the Ex-Cell-O mechanism for lining up all eight cemented-carbide-tipped tools at the standard location in front. At the end of the cut, as the spindles are ready for the upward stroke, a hydraulic bar at the lower end tilts the work and fixture slightly to permit the tools to clear without injuring the bore.

Blocks then are water tested, inspected, and go to the OilGear semi-automatic hydraulic press for pressing in the cam line bearings. This machine

is quite unique in that the work is completely exposed for the operator's inspection during the process. It has hinged arms, one for each bearing, which swing out of the way after the bearings have been pressed in. While the arms are in the out position, the operator presses the bushings over the end of each arm. Then he moves the block into position in the fixture. From this point on, the operation is completely automatic since the machine cycle begins the moment the work is pushed in position.

Last operation of this series is the finish-boring of the camshaft bearings, finish-reaming and facing of the distributor hole, and reaming of flywheel housing and gear cover dowel holes in one setting in a Greenlee three-way cam and crank machine. Two of these machines are installed on the line. They represent a great advance over previous equipment designed for similar operations.

The next operation is rather interesting and unusual. Since the block travels on the head-gasket surface for a considerable portion of the machine line, it was felt desirable to leave some stock for providing a fine gasket surface after all machining had been completed. This finishing operation is done in a new Cincinnati horizontal Hydro-Broach which removes about 0.015 in. of stock to a fine surface finish. Important feature here is that flatness and parallelism with respect to the pan rail are held to a limit of 0.003 in.

From the Cincinnati the blocks move on to the No. 214 Barnesdrill honing machine (fitted with the automatic three-station fixtures described earlier) for honing of the bores. This is followed by inspection of bores and sizing for selective piston fit.

Sizing is a new development and is done in a battery of unique Sheffield Precisionnaire gaging machines designed for this application. As illustrated, each of these machines has 32 gaging tubes, four for each cylinder. In operation, the inspector slides the blocks onto the loading station and the fixture automatically moves it into position under the gaging heads and locks the work in place. At this point, eight gaging lances are moved upward into the cylinder bores. Each of the lances has four gaging points along one element of the bore, each of the four points being connected to one of the four tubes for each cylinder.

The top center reading for each cylinder determines the size for piston fit, the total limit on the bore accommodating 10 different piston sizes. The gaging lances also are provided with an indexing arrangement which permits the operator to select any other element for checking. However, this is done only when some production prob-

lem warrants still further checking.

Just above the work fixture, as may be seen in the illustration, is a group of eight levers used for stamping the number corresponding to the reading of the top center gage point. As the gaging is completed, the operator rapidly sets the numerals on each lever to correspond to the gage reading for each cylinder and brings the lever down on the work to impress the marking.

After sizing, the blocks go into the Vulcan precision washing machine built in the conveyor line for washing and blow-off. This, too, is a transfer type machine designed to pick up the work automatically and carry it through to the unloading station. As the work reaches the washing station, lances automatically enter the block to clear all oil holes.

Following washing, we reach the Parko-Lubrite process machines. Two of these are installed on the line, each one consisting of 24 fixtures mounted on an oval-shaped merry-go-round conveyor. The cycle of operations takes 15 minutes. Using a hoist, the operator sets the block, head down, onto the fixture where the head rests on a gasket. Each fixture has eight standpipes which fit into the cylinder bores with the top of the standpipe just short of the barrel opening to prevent the etchant from spilling into the crankcase opening. Each fixture is provided with an individual pump for circulating the etching fluid and as the block is installed the fluid begins to rise around the standpipes until the cylinder barrels are almost full. The fluid rises around the standpipe and is discharged through the standpipe.

At the end of 15 minutes the electrolytic bath has completed the etching process and the block is ready for removal at its unloading station.

After etching, the blocks are transferred to another group of No. 214 Barnesdrill honing machines, fitted with cast iron laps for lapping the bores to remove the fine coating of "fuzz" left by the etching process. The work then is washed in a large Detrex alkali washer and is ready for delivery to the assembly department.

In the case of the Ingersoll mills, in particular, the process produces an enormous load of chips. Accordingly, they have installed a chip conveyor in the floor to carry chips to the end of the group of machines. A flight conveyor at this point then picks up the chips and dumps them into a suitable receptacle. This conveyor system was supplied by Palmer-Bee. The big Natco 19-station machine, another heavy producer of chips, has its own built-in chip disposal system consisting of a flight conveyor supplied by Link-Belt.

The Greenlee machines also are provided with chip conveyors and with cross conveyors delivering the chips to movable receptacles. These receptacles have all been located at spots accessible to electric trucks for hauling the chips from the department.



BRONZE BEARINGS

BUSHINGS

PRECISION BRONZE BARS

*S*leeve Bearings are free from complication. Requiring no shaft shoulders, no threaded shaft, no locknuts, they present the ultimate in straightforward trouble-free design. The Bunting Cast Bronze Sleeve Bearing is the popular leader in its field. Consult the Bunting Engineers. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

Bunting

Direct Fuel Injection

(Continued from page 29)

line from being evacuated at the next stroke of the plunger. The point at which the center port in the plunger is opened by the annulus and port in the bushing is termed the "end of injection." Since the geometric "end of injection" always occurs at the same point in the plunger cycle, this point is used in timing the pumps. Each pump is set at the place of manufacture so that when the ball on the tim-

ing cam arm slips into the groove in the pump drive shaft, No. 1 plunger has reached the "end of injection."

The position of by-passes on the plungers determines the effective length of the pumping stroke, the latter increasing as the by-passes are moved farther down on the plungers toward the pump wobble plate. The position of the by-passes is set by means of the by-pass control plate which holds them

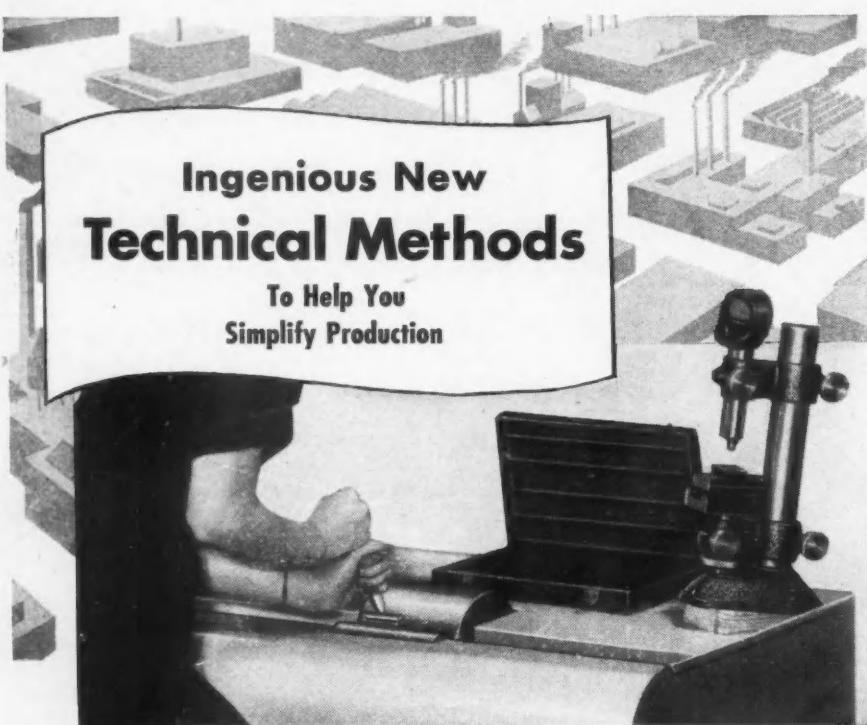
in the same relative position on the plungers. The by-pass control plate is operated through the control shaft, by the pump control diaphragm in the pump control shaft housing, and the by-pass control spring in the lower portion of the pump body. Metered fuel pressure is applied on one side of this diaphragm (two diaphragms in actual pump) and boost venturi suction on the other side. This force (metered fuel-pressure minus boost venturi-suction) overcomes the force of the by-pass control spring which in turn tends to move the by-passes into the "idle cut-off" position. In this way the diaphragm properly locates the by-passes so that the plungers will pump the total volume of fuel being required by the master control.

As the air-flow and fuel-flow through the master control increases (throttle opened wider), the fuel flow and boost venturi suction becomes greater and the pressure differential between the two chambers in the pump control housing increases. This compresses the by-pass control spring, causing the by-pass control plate to move the by-passes downward, thereby increasing the effective length of the plunger pumping stroke. As the air-flow and fuel-flow decreases (throttle moved toward the closed position), the pressure differential decreases; the by-pass control spring then moves the by-passes upward, shortening the effective length of the plunger pumping stroke.

When the manual mixture control lever is placed in the "idle cut-off" position, the fuel flow to the injection pump ceases, reduces the fuel pressure on the pump control diaphragm. The by-pass control spring then raises the by-passes to a position such that, even though the plungers are traveling their full stroke, the lower ports in the plungers will never be covered. Therefore, no fuel will be under sufficient pressure to open the check valves, and no fuel will be delivered to the engine. A similar action will occur if the fuel supply is exhausted from the fuel tanks while the airplane is in flight; that is, the by-passes will move to the "idle cut-off" position, stop the fuel-flow to the engine, and leave the pump bodies full of fuel and ready for instantaneous pumping as soon as pressure is again restored. Then, as the pumps are rotated by the "windmilling" of the engine, no damage will be done to the pumping mechanisms through lack of lubrication, as the fuel in the pumps will provide the necessary lubrication.

The driving mechanism of each pump is lubricated by engine oil, at engine oil pump pressure, fed through a channel in the mounting flange. The oil flows through the lower driving mechanism and drains back through the bearings into the engine oil sump. Vapor is eliminated from each pump through a vent float and valve system in a housing in the top of the pump control shaft housing. The float is held

(Turn to page 67, please)



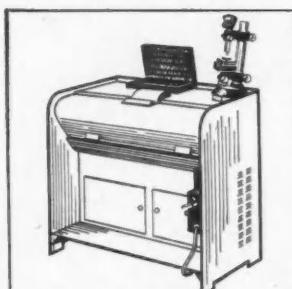
New Centerless Lapping Machine Gives Precision of Less Than 2 Micro-Inches!

Now it's easy to lap cylindrical pieces—quickly—accurately—without specialized operator skill! The new Size Control Centerless Lapping Machine handles pieces from .010" to 10" diameter without costly set-ups.

The operator merely holds piece between lapping rolls with stick. Pressure applied determines quantity of metal removed. Small roll turns piece at slow constant rate. Large roll turns more rapidly to remove minute quantities of metal. Ideal for lapping oversize gages, worn gage plugs to next smaller size, bearings, bushings or shafts. Roll speeds easily changed. Adjustable for tapers.

Ideal also to save time on the job, is chewing gum. The act of chewing aids the workers' concentration; seems to make work go easier. Furthermore, chewing gum may be used even when both hands are busy—increasing worker safety—and reducing work interruptions. That is why many plant owners have made Wrigley's Spearmint Gum available to all.

You can get complete information from
Size Control Company
2500 Washington Blvd., Chicago 12, Ill.



Centerless Lapping Machine



AB-54



"...and add salt to taste"

TO PLEASE the gourmet's palate, the expert chef adds just enough seasoning. To provide castings of specified strength and quality, expert C.W.C. metallurgists accurately control the addition of alloys to iron and steel. This is but one of the many specialized operations which enables Campbell, Wyant and Cannon foundries to produce castings that meet the exact requirements of the customer.

Painting: Adding alloys to the ladle as molten metal leaves electric furnace.

CWC

Campbell, Wyant and Cannon Foundries

MUSKEGON, MICHIGAN Henry Street
Plant, Sanford Street Plant, Broadway Plant

SOUTH HAVEN, MICHIGAN National Motor Castings Division

LANSING, MICHIGAN Centrifugal Fusing Company

CAMPBELL, WYANT AND CANNON FOUNDRY COMPANY
MUSKEGON, MICHIGAN



BUT...

CHEMICALS
ACP
PROCESSES

RUST PROOFING AND
PAINT BONDING

Granodine
Duridine
Alodine
Lithoform
Thermoil-Granodine

RUST REMOVING AND
PREVENTING

Deoxidine
Peraline

PICKLING ACID INHIBITORS

Rodine

Old fashioned methods are costly. That's why it pays to use the best available modern products when preparing metal surfaces for painting.

*Granodine**
& Duridine

—used in power spray washers—produce a uniform, finely textured phosphate coating on steel and iron, transforming the surface of the metal into a non-metallic, non-conductive layer that will take and maintain a beautiful, enduring, lustrous finish.

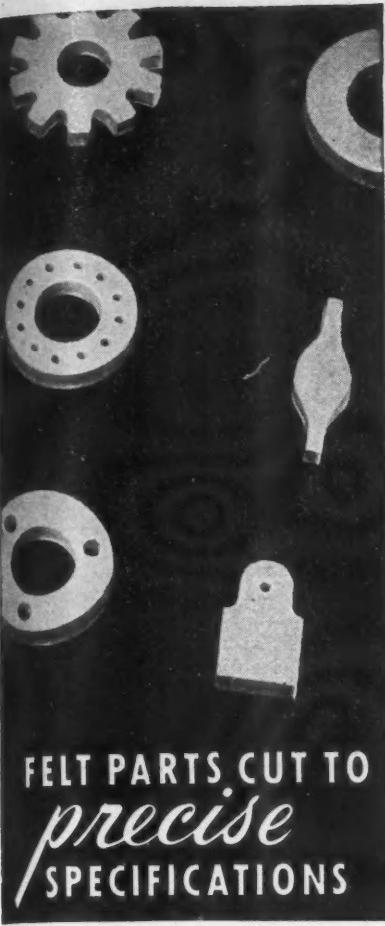
GRANODINE* & DURIDINE are fast, efficient workers. They reduce production costs, save time, minimize paint outlay.

Both are ready to serve you. Your production problems will determine your choice -- and our technical advisers will gladly assist you in your selection.

* Trade Mark Reg. U. S. Pat. Off.

ACP

**AMERICAN CHEMICAL PAINT CO.
AMBLER PENNA.**



FELT PARTS CUT TO precise SPECIFICATIONS

Skilled operators and Booth-designed machinery combine to give you the utmost in accuracy of die-cut mechanical felt parts. Specifications are adhered to precisely. No deviations in size or thickness... the last felt part in any one lot is an exact duplicate of the first.

Prompt deliveries are routine at Booth and your order, small or large, receives interested attention.

APPLICATION CHART AND SAMPLE KIT... contains swatches of S.A.E. felt types, with specification tables. Write for it. (No sales follow-up.)

THE BOOTH FELT COMPANY

481 19th Street Brooklyn 15, N. Y.
737 Sherman Street Chicago 5, Ill.

2320

Booth
TRADE MARK

**PRECISION CUT
FELT PARTS**

in place within a cage, which allows the float to move up and down as the fuel level in the pump rises or falls.

Since this is a dual pump installation on an 18-cylinder engine, it is very important to have the two pumps synchronized as to the position of the bypass control plate which controls the output position of the by-passes and, which in turn, controls the output of the separate pump plungers. For this reason, there is an external lever on each pump which, in conjunction with the pump control diaphragm, controls the position of the by-pass control plate. These two levers are connected through a link rod to synchronize the two external levers and, in turn, the position of the by-pass control plates. This link rod is not connected with the pilot's control.

(A detailed drawing of the Bendix direct fuel-injection system, and a complete description of the operation of the master fuel-control unit will appear in an early issue of AUTOMOTIVE and AVIATION INDUSTRIES.)

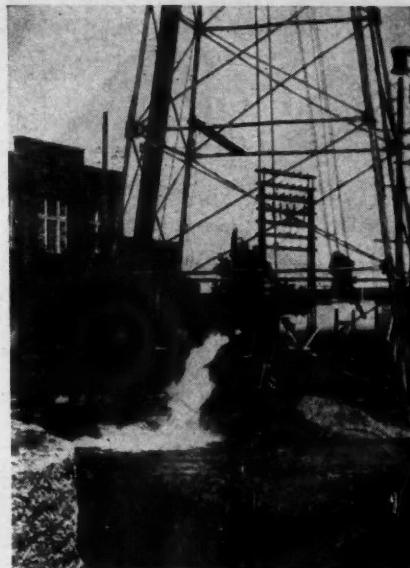
New Italian Car Has V-12 Engine

A new Italian designed and built sports car, the Ferrari type 125, features a V-12 overhead valve engine, independent front-wheel suspension, and a leaf spring rear suspension system. Three models are planned: the Sports, Competition, and a racing model, the Grand Prix.

The 12-cylinder overhead valve engine will be built in two blocks of six cylinders set at an angle of 60 degrees to each other. It will have a 2.16 in. bore, 2.06 in. stroke, and a displacement of 91.3 cu in. Three downdraft carburetors will be mounted between the cylinder blocks. With a compression ratio of 7.5 to 1, the Sports model engine will develop 75 bhp at 5400 rpm and the Competition model will develop 118 bhp at 6800 rpm. Maximum road speed for the two cars is given as approximately 105 and 130 mph, respectively. Performance figures on the racing model, the Grand Prix, have not been released, except that it will turn up 8000 rpm with a three-stage supercharger and an inter-cooler.

The chassis frame will be steel tubing of oval cross section with heavy tubular cross bracing behind the transmission. The independent front-wheel suspension will consist of a low-slung transverse leaf spring and articulated arms to the wheels damped by large hydraulic dampers. The rear suspension will have half-elliptic springs, also with hydraulic dampers, and will incorporate a torsion bar stabilizer across the frame ahead of the rear wheels. Wheelbase will be 93.5 in. and tread 48.75 in.

**AUTOMOTIVE and AVIATION
INDUSTRIES** readers are always
well informed.



WATER MEANS A LOT TO CITIES LIKE SIOUX FALLS, S. D.

Sioux Falls, S. D., is a typical American City. Like many other smaller towns, it is growing into a much more important distribution and manufacturing point. Water for further growth was needed in large—but economical quantities. The choice was a Layne Well Water System that is now producing a million gallons daily.

Sioux Falls is not burdened by high operation cost, and furthermore there will be very little—or perhaps no repair expense for years to come.

Layne Well Water Systems, used and famous the world over, are engineered for heavier duty than ever called upon to perform. Such extra ruggedness and remarkably fine quality makes them an unmatched investment for any city or industry. These Well Water Systems are built in a wide range of capacities suitable for present needs and future growth. Space requirements are small and installations can be completed in a matter of weeks.

For further information, literature, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Layne-Wisconsin Co., Milwaukee, Wis. * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio. * Layne-Pacific, Inc., Seattle, Wash. * Layne-Texas Co., Houston, Texas. * Layne-Western Co., Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.



**WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS**

New Production Equipment

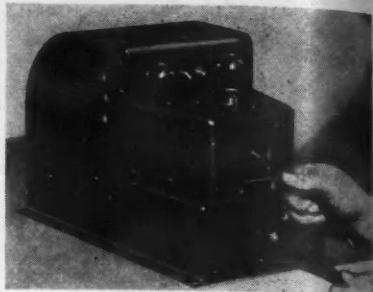
(Continued from page 43)

tion or rubber covering from fine stranded or solid conductors.

When a wire is inserted between the special heat-resistant blades and foot pedal is depressed, two parallel grooves are burned through the insulation, down to the conductor. A slight twist completes the groove and a pull removes the insulation. A built-in exhaust draws smoke and fumes of burning insulation away from blades. The stripings fall into a water drawer

where any burning particles are quickly extinguished.

Since different wire insulations strip differently, each blade has an individual heat control and transformer to permit raising or lowering the burning temperature as required for the particular insulation. A "Hi-Lo" switch, mounted between the blade controls, controls the adjustment of heat for heavy, average and light insulation. The blades may be set at exact wire diameters, and an



Ideal wire stripper

adjustable stop controls the length of stripping.

This "good luck" token gets results

Aetna

It's one thing to "wish" good luck for a product. It's quite another to make dead-sure of its successful long life—by building into it the excellence typified by Aetna Bearings.

Advantages of the Aetna "T" Type Clutch Release Bearing are practical and to the point—

- permanent true alignment of raceways—no eccentric thrust, no chatter, no excessive wear
- an oil-impregnated bronze retainer provides smooth, silent, enduring bronze-to-steel contact
- prelubricated for life

These are the potent reasons why a majority of leading vehicle manufacturers, year after year, look upon the Aetna "T" Type Clutch Release Bearing as a trusted stand-by for a crucial "key position."

A simple, sensible step toward good luck and a long life for your product is to consult with Aetna engineers. Aetna Ball & Roller Bearing Co., 4600 Schubert Ave., Chicago 39, Illinois.

In Detroit: Sam T. Keller
7310 Woodward Avenue Phone: Madison 8840-1-2

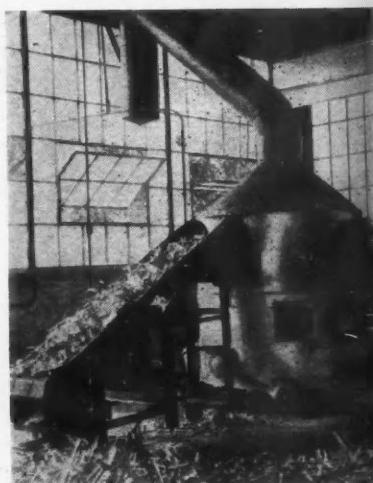
MAKERS of
THRUST BALL BEARINGS,
Standard and Special.
ANGULAR CONTACT
BALL BEARINGS
ROLLER BEARINGS
... Special,
BALL RETAINERS,
HARDENED and
GROUND WASHERS

THE NATIONAL AUTOMATIC TOOL CO., INC., Richmond, Ind., is introducing NATCO automatic clamping for fixtures in connection with automatic processing machines for drilling and tapping. NATCO automatic power clamping is arranged for either hydraulic or electric operation and is said to completely eliminate wrenches.

A HAND-OPERATED tool room surface grinder has just been brought out by the DoALL Co., Des Plaines, Ill. Known as the Model GH, it has heavy, deep "V" ways between saddle and base and one "V" and one flat way between table and saddle. All ways are hand scraped and are given constant auto-

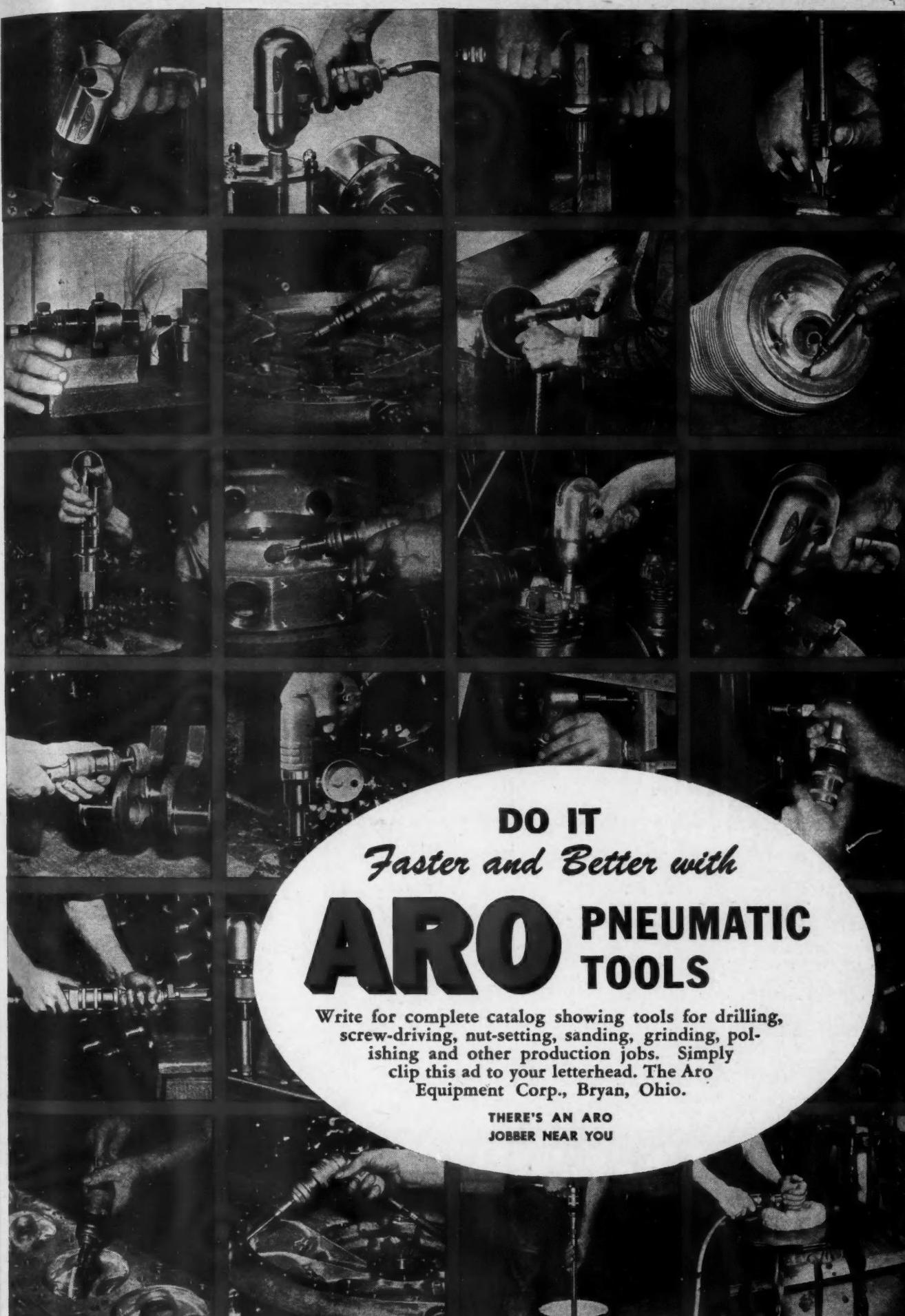
(Turn to page 70, please)

Die Casting Alloying Pots



Gas fired, die casting alloying pots, ranging in capacity from 2000 to 10,000 lb per hr with a temperature range of 350 to 1200 F, and fed with a continuous type conveyor, are being manufactured by the Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit 7, Mich. They are used in die casting plants for reclaiming sprues and other scrap material and can also be employed for alloying die cast metal. Shown here is the 6000 lb per hr model

Aetna  **BALL & ROLLER BEARINGS**



DO IT
Faster and Better with
**ARO PNEUMATIC
TOOLS**

Write for complete catalog showing tools for drilling, screw-driving, nut-setting, sanding, grinding, polishing and other production jobs. Simply clip this ad to your letterhead. The Aro Equipment Corp., Bryan, Ohio.

THERE'S AN ARO
JOBBER NEAR YOU

matic lubrication by a gravity feed oiling system.

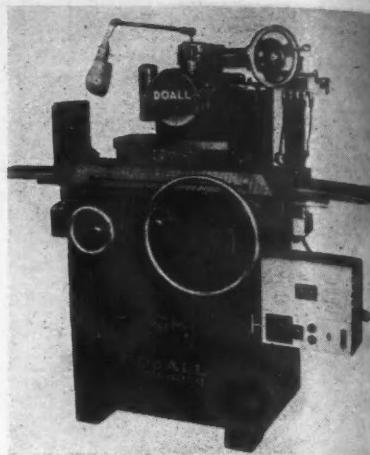
Another feature of this grinder is the cartridge-type direct drive spindle as standard equipment. This spindle has super-precision ball bearings throughout with automatic take up for wear. The direct coupled one hp motor and the spindle itself are dynamically balanced and are totally enclosed.

The precision elevating screw and the cross feed screw operate through four-in. bronze nuts to minimize wear. The hand wheel for the spindle elevating screw is graduated in half thousandths with vernier adjustment to .0001 in. The hand wheel for cross

feed is graduated in thousandths with vernier adjustment to .0001 in.

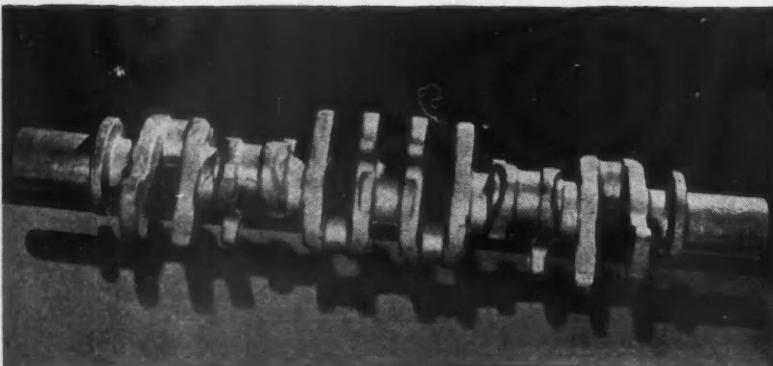
THE CODECO wire stripping machine, which cuts, strips, and slits one, two and three conductor wire up to $\frac{1}{2}$ in. diameter, has been placed on the market by the Williams Products Co., Middletown, Conn. One or all of the three basic operations are performed simultaneously on both ends of the cord.

The Codeco stripper is operated by compressed air and is equipped with a Bellows-Senacon BM5 air motor and a Norgren 645-2 Lubro-Unit. Sixty lb



DoALL Model GH surface grinder

air pressure will operate the machine to process most cord. Hardened steel knives are adjusted to cut, strip and slit to the user's specifications. The knives are readily changed for other specifications. All stripped material is removed automatically, thus eliminating the possibility of damage to the



OUTSTANDING EXAMPLE of modern forging technique—an inline aircraft engine crankshaft forging—a six throw, seven bearing design having twelve integrally forged counterweights. Starting as a straight bar of alloy steel, the material is successively worked through the various forging operations to produce the ultimate shape, having flow lines carefully directed to provide greatest strength in the critical sections.

Standard of the Industry for Sixty Years

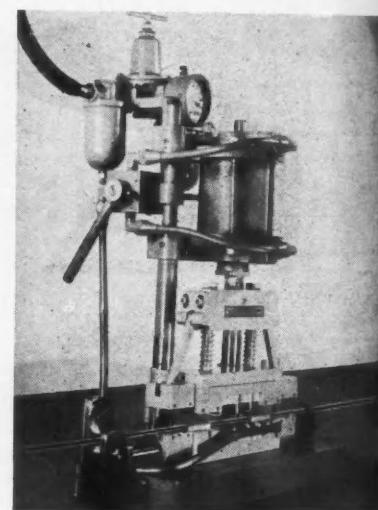
WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS

DETROIT, MICHIGAN



Codeco wire stripping machine

knives in cleaning. Bronze bearings are used throughout.

The Codeco machine measures 18 in. wide, 11 in. deep and 25 in. high and weighs approximately 75 lb.

A. F. HOLDEN Co., 200 Winchester St., New Haven, Conn., is building a new furnace for use in austempering and martempering. It is called a Marquenching furnace because the parts are quenched into the furnace and cooled to the point where they are at bath temperature, and then cooled to the finished transformation of martensite.

Features of this furnace are the following:
(Turn to page 74, please)

Thanks for the kind words...

(EVEN IF WE DON'T DESERVE THEM)

Nobody knows as well as we here at "National" how far we have fallen short of giving our normal standard of service to our customers during these difficult times.

This generous letter, written to us by an important customer recently, can only be taken gratefully as recognition on his part that we have tried. And we will certainly "do our damnedest" to live up to the spirit of this letter, in all our customer relationships.



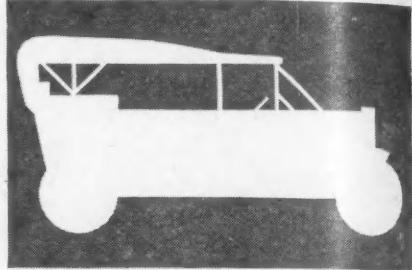
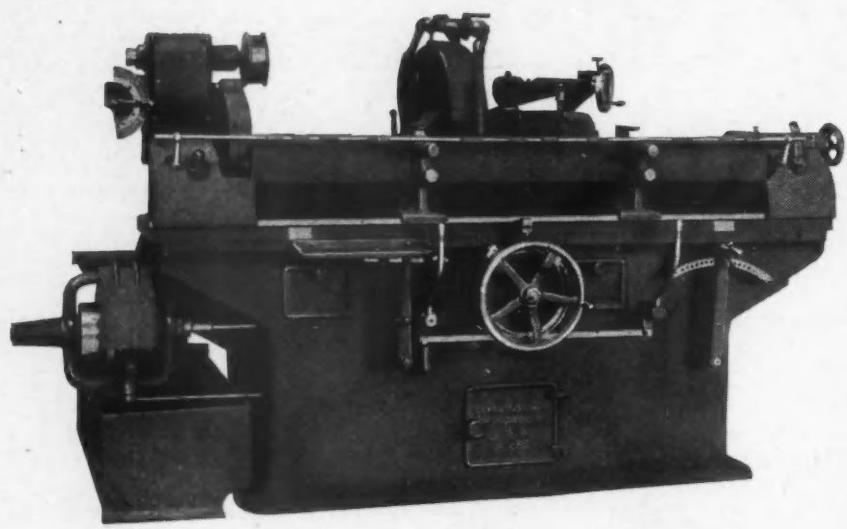
"I want to thank you for the way you and your organization are handling our business. I know we have been in some tight spots, but you have been able to work with us and help us over these situations. This is certainly the kind of sources we want to do business with."

"We have a long way to go before we get back to normal, and we are going to have problems facing both of us, but I know your organization will do everything they can when we call upon them."

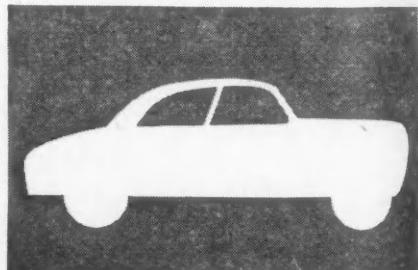
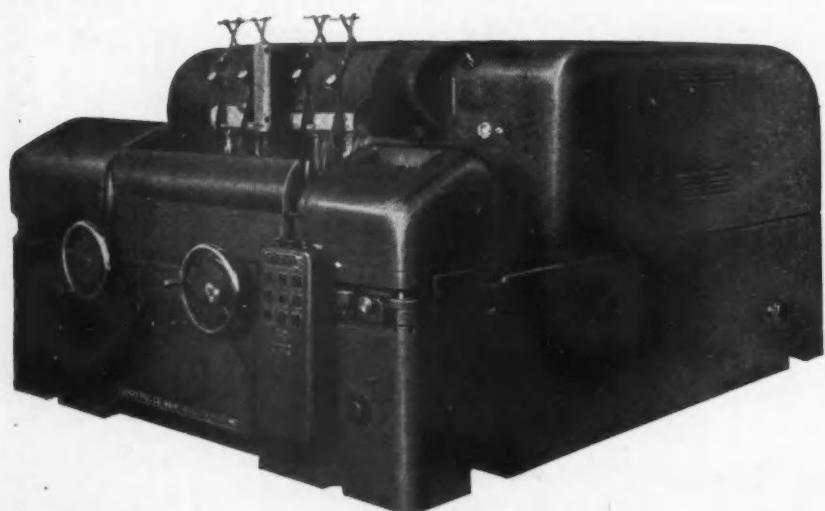
"NATIONAL SCREW" SPECIALTIES INCLUDE:

- Clutch Head Screws
- Davis Blind Fasteners
- Drake Lock Nuts
- Dynamic Lock Nuts
- Hi-Shear Rivet Pins and Collars
- Huglock Nuts
- Laminar Flow Screws
- Lok-Thred Studs
- Marsden Lock Nuts
- Phillips Recessed Screws
- Place Bolts
- Rosan Locking System
- Scrivets
- Sems

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.



How LANDIS TOOL Improved Crankshaft Grinding



comparison

GRINDING LINE BEARINGS



Production 3.2

Number of Grinding

Operations 20

Accuracy002" on dia.

- Progress in internal combustion engines has been
- paralleled by Landis Tool Company improvements
- in crankshaft production that lower costs, improve
- finishes, give better bearing alignment and reduce
- diameter variation.
- Large diameter wheels, hydraulic feeds, and the
- simultaneous grinding of multiple diameters are
- among the more important Landis Tool automo-
- tive crankshaft grinding developments.

to Give Better Engines at Lower Cost

Production 32

Number of Grinding

Operations 1

Accuracy0005" on dia.

- By elimination of the semi-finishing operation and
- other handling, production increased tenfold and
- unit cost decreased sharply.
- Whatever your grinding need, you will find a
- Landis Tool precision grinder with latest features
- for high production and close accuracy.

58

LANDIS TOOL
Precision Grinders
LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

Holden Marquenching furnace

lowing: A positive action pump which circulates the liquid completely every three and a half minutes; a positive cooling area—by pumping into troughs and back over a spillway into the pumping section; additional cooling by blowing air at 16 oz of pressure for any volume under the spillway; a positive method of filtering out hardening salt or scale by a series of screens; and automatic control of temperature both in the quenching area and cooling area.

The normal operating range of this



unit is 350-750 F—at the lower temperature for Martempering, and from 500-750 F for austempering. Heating may be either by electricity or gas.

LAATEST addition to the line of the Lyon-Raymond Corp., 3175 Madison St., Greene, N. Y., is a 2000-lb capacity hand pallet truck.

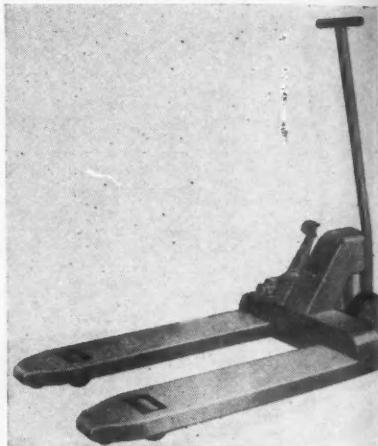
Total enclosure of working parts serves to protect them as well as give a streamlined appearance to the truck. The use of high strength alloy sheet steel formed into box sections for the frame, and aluminum alloy for wheels and other non-structural parts insures a minimum of weight.



A distinctive feature of GUNITE Cast Steel Trailer Wheels is the *continuous web* which, in section, resembles the diagonal braces in a bridge truss. When the rims are seated on the off-set bearing surfaces, the assembly achieves a true truss construction. This provides maximum strength and rigidity with minimum weight. The complete assembly includes a specially-engineered Gunite rib-type long-life Brake Drum. The wheel is furnished with bearing cups, rim spacer, cast hub cap, and all rim-attaching parts. Gunite Trailer Wheels are available for 15000, 16000, 17000, and 18000-pound axles. Write for detailed specifications and deliveries.



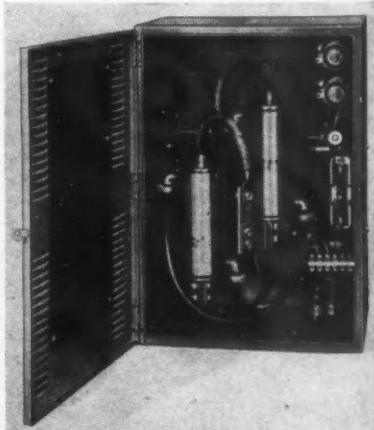
GUNITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES



Lyon-Raymond hand pallet truck

Elevation is accomplished through a hydraulic foot pump, especially designed for the truck. Length of stroke is optional, depending on the stature of the operator. Lowering results from pushing the foot pedal forward. The pump is equipped with a relief valve to prevent overloading and possible damage.

FOR RESISTANCE WELDING jobs involving exceptionally high speed operation (Turn to page 76, please)



Square D electronic contactor

Here are some of the things you can do with TRANSFAX... **KODAK'S new reproduction process**

Kodak

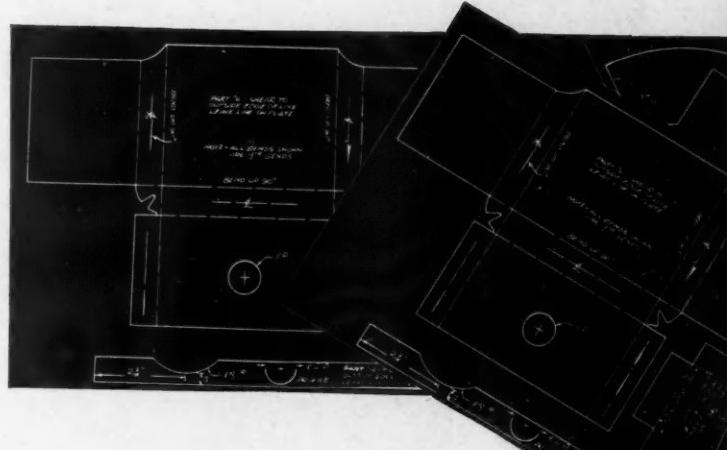


You can make dials...

No matter the size or shape of the scale on your dials, Transfax can produce copies... on a production line basis... that are exact duplicates of the original pattern.

You can reproduce drawings...

With Transfax, you can put fabricating instructions, dimensions, layout lines directly on metal... save time and money whether one or hundreds of transfers are involved.



You can make name plates...



You can reproduce designs, legends, almost any marking. Lettering can be in Transfax white against any color background, or in reverse with Transfax as a white background. An integral part of the product, it won't deteriorate... or discolor... with age.

No darkroom needed—Transfax is a simple process. Transfax is a white, light-sensitive, quick-drying preparation you spray on. It requires a minimum of equipment and space and can be handled by anyone with ordinary skill.

Transfax is fast. Spray it on (some surfaces call for special primers)... place a transparent or translucent original of your pattern in contact with the sensitized Transfax surface. Expose to light... wash the Transfax surface with dilute Transfax Clearing Solution. Dry it. Overcoat it for permanence. The complete operation is done in minutes!

Transfax is durable. Overcoated, Transfax reproductions are rubproof, oilproof, do not deteriorate or change color with age... will resist a cutting flame until the underlying metal melts away.

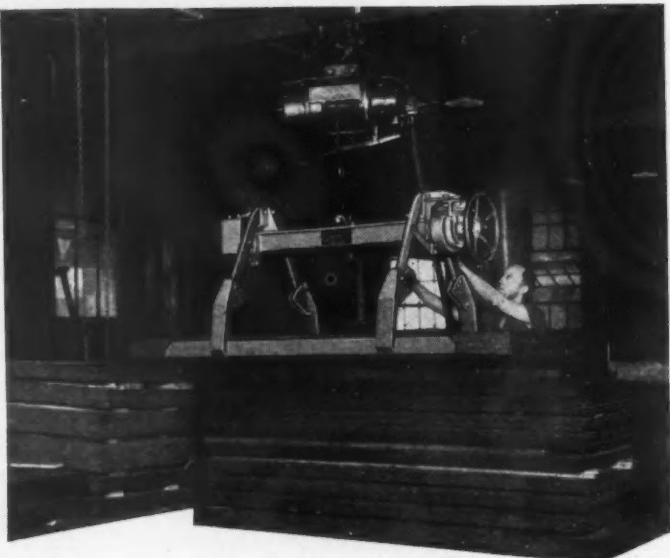
Do you have a reproduction operation? If you do, write and tell us about your product... its markings... and the type of product surface. We will then be glad to suggest how the Kodak Transfax Process can be applied to your operations.

EASTMAN KODAK COMPANY
Industrial Photographic Division • Rochester 4, N. Y.

KODAK TRANSFAX PROCESS A revolutionary new reproduction method

Engineering Library

Profits Begin Here . . .



When carloads of sheet stock are unloaded at the receiving room, actual manufacturing costs begin. But, when sheet stock is unloaded and carried into storage or to the machines with C-F Sheet Lifters, these costs are minimized—stock damage is eliminated and your end profit begins. Because C-F Sheet Lifters, under one man end or remote cab control, handle more sheets per load, safer, faster and more economically, they are the logical answer to

the demand for modern, low cost materials handling.

There are C-F Lifters in capacities from 2 to 60 tons or larger, in standard or semi-special designs to meet any sheet or materials handling requirement. Write for new Bulletin just off the press.

Cullen-Friestd Co., 1322 S. Kilbourn Ave., Chicago 23, Ill.

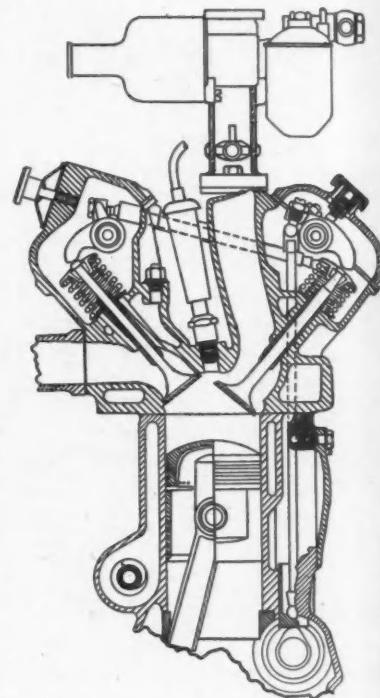
CULLEN-FRIESTED CO., CHICAGO 23, ILL.

tion or heavy primary currents of short time duration, Square D Co., Milwaukee, Wis., offers a line of electronic contactors using ignitron tubes.

Design of the new Class 8990 electronic contactors provides increased wiring space with power connections made near the center of the enclosure allowing minimum bending of power cables. The contactor is assembled on a removable steel base plate. All control elements are grouped at the right hand side away from tubes and cables, and out of the path of any dripping from water condensation on tubes and hoses.

Cabinets are sheet steel with ventilating louvres in the door and drain holes in the bottom. Flat door construction is used to permit close ganging of contactors and provide maximum utilization of space.

Frazer Nash-Bristol



Shown here is the cylinder and valve arrangement of the 100 hp engine of the new Frazer Nash-Bristol automobile, entry of the Bristol Aeroplane Co., Ltd., Great Britain, into the automotive industry. The camshaft, located in the crankcase, operates both the inlet and exhaust valves. The Frazer Nash-Bristol was described in the January 15 issue of AUTOMOTIVE and AVIATION INDUSTRIES.



2 MACHINES INSTEAD OF 4

THIS crankshaft illustrated (full size) is produced by a leading manufacturer and is typical of scores of such parts being turned out throughout the nation.

The accepted procedure is to cut bar stock to length on a cut-off machine, and perform the other operations on three chucking machines . . . a relatively slow, costly procedure.

New Britain engineers proposed a complete departure: The long end is turned and the short end formed on a New Britain Six-Spindle Automatic Screw Machine. All the remaining cuts are accomplished on one New Britain Six-Spindle Automatic Chucking Machine. The same number of cuts — the same finish — with two machines instead of four. The savings in time, labor and machines are spectacular.

Lower production costs are the one key to more sales, more jobs, more prosperity. New Britain Machines and progressive New Britain research and engineering have teamed to make *New Britain* a by-word for production since the earliest days of modern machine tools. They stand ready to serve you and your business.

New Britain Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

ENGINEERING DETAILS

With the use of eccentric collets, the shank end and out-board support diameter are turned to grinding size and the piece cut off.

On the second operation, on a New Britain toolled as a chucker, and again using eccentric collets, the crank pin diameter is formed and the two shoulders of the crank shaft throw are faced.

Previous experience in machining this part revealed that the throws of the crank pin had a tendency to spread when the metal was removed. This difficulty is overcome by forming in successive steps down to the crank pin diameter and finally taking a light finish facing cut on each throw of the crankshaft. Parallelism between the center lines of both ends of the main shaft and the crank pin are thus held within the desired tolerance.

New Products

(Continued from page 47)

stainless and stainless clad, alloy steel, aluminum, bronzes and brasses, cast iron, Monel, Inconel and nickel. The process—known as the Arcos Oxyarc process—achieves the cutting by the combination of an electric arc and a stream of oxygen.

The equipment consists of a specially designed Arcos Oxyarc holder, and a tubular coated Oxycuttend rod which is consumed in the process of cutting. The process can be used wherever an

ac or dc welder and bottled oxygen are available.

Ultrasonic Tester

An ultrasonic materials tester designed to indicate the presence of voids, cracks, porosity, laminations, poor bonds, and other internal flaws in metals, plastics, and ceramics has been introduced by the Special Products Division of the General Electric Co.

ONE SOLVENT...

for all Metals or Combination of Metals

STEEL COPPER BRASS ALUMINUM PRECIOUS METAL

FOR SOLVENT VAPOR DEGREASERS

No need to use a special solvent for cleaning a combination of metals—BLACOSOLV degreases them all... Safely... Quickly... Economically.

BLACOSOLV is the most highly stabilized solvent... ideal for aluminum, magnesium, brass, copper, steel, etc., either individually or in combination. It is non-inflammable—is positively safe—will not stain or dull even the most highly polished surfaces... the one price solvent for all metal degreasing jobs. Its economy is increased in the uninterrupted service it affords you in your production.

Write today for FREE BOOKLET ON Degreasers and application with Blacosolv the all purpose de-greasing solvent.

G. S. BLAKESLEE & CO.

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N.Y. TORONTO, ONT.

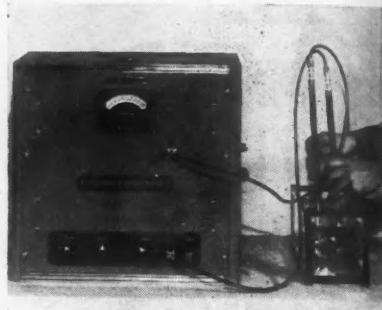
BLACOSOLV
DEGREASERS AND SOLVENT

NIAGARA
METAL PARTS WASHERS

The tester is useful in production testing of metal castings, forgings, or finished machined parts, as well as plastic or ceramic parts.

The new tester sends a beam of ultrasonic waves through the specimen being tested. Changes in the amount of energy transmitted through the specimen are an indication of the presence and extent of flaws. The tester is portable and self-contained, and provides a direct reading. Testing is not affected by small changes in dimensions or position of test pieces.

The instrument consists of a complete wide-band ultrasonic transmitting-receiving system having a high-frequency generator, a crystal transducer for producing ultrasonic vibrations, a satisfactory medium such as water to transmit these vibrations, a second



G. E. Ultrasonic materials tester

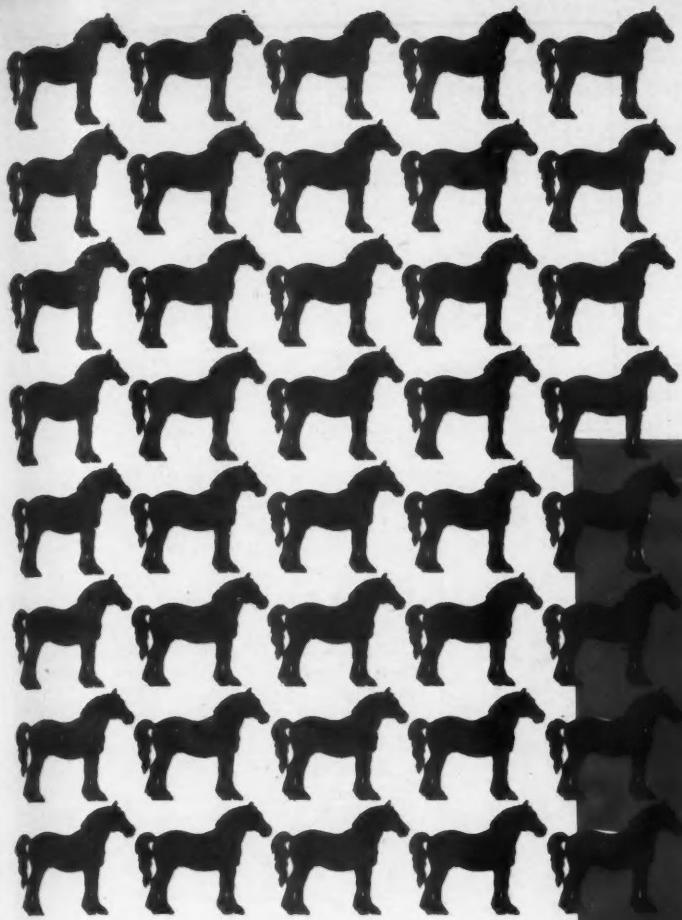
crystal transducer to convert the received mechanical energy into electrical signals, and an indicator supplying information for materials inspection or analysis.

To examine regularly-shaped specimens, the two transducers are immersed in a tank containing water, and the specimen is inserted between them. Ultrasonic waves are then sent through the specimen, and the resulting reading on the indicating instrument is compared with that for a specimen shown to be sound by X-ray, mechanical breakage, or sectioning methods. Internal flaws will produce measurable decreases in total transmission of waves through the specimen, and a consequent drop in the instrument reading.

The instrument can also be used to indicate changes of viscosity, compressibility, and density of liquids, when these significantly alter the velocity or attenuation of ultrasonic transmission.

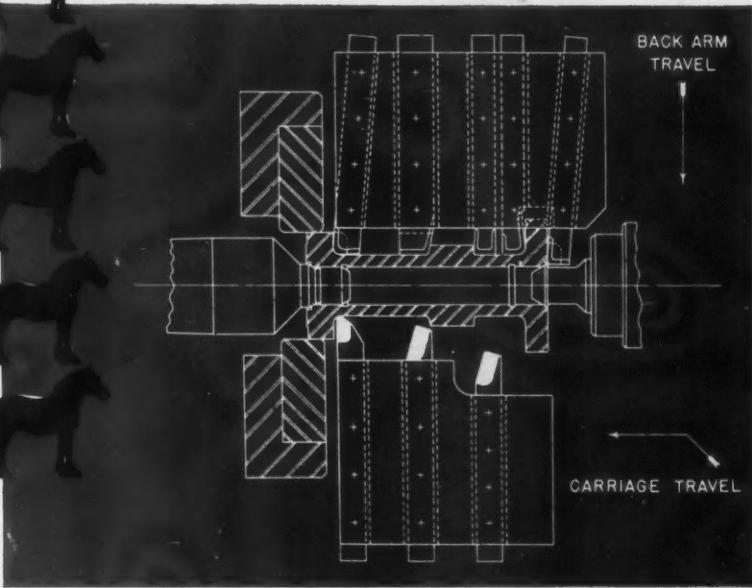
Wheel and Rim Association Elects Dennerline

At the Annual Meeting of the National Wheel and Rim Association, held at Chicago, Fred W. Dennerline, was elected president to succeed John F. Creamer, whose term had expired. Mr. Dennerline is president and founder of the Indiana Wheel and Rim Co., Indianapolis, Ind.



1st. Turning Operation on an Automobile Transmission Counter Gear

How much HORSEPOWER are You using ?



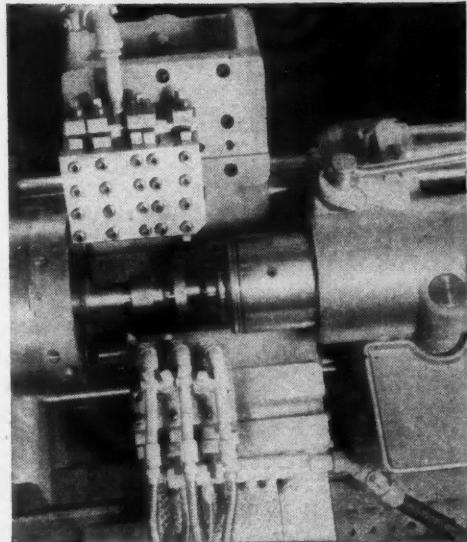
In this operation a 16" Fay Automatic Lathe transmits **40 HORSEPOWER** to remove **25 ounces of metal in 19 seconds** with carbide cutting tools.

Carbide cutting tools have increased horsepower requirements as much as 300 per cent. They have increased cutting speeds 200 to 500 per cent.

Be skeptical of the production efficiency of your metal turning equipment. The chances are that turning accounts for 25 per cent or more of all machining time in your plant—that this is your major production expense.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the efficient use of carbide cutting tools on Jones & Lamson machines. Our Turret Lathes and Fay Automatic Lathes are designed specifically for the most efficient use of these tools.

Send for our folder "Turning Automobile Counter Gears". Or better yet, telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U. S. A.

Fay Automatic Lathes

Manufacturer of

Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies

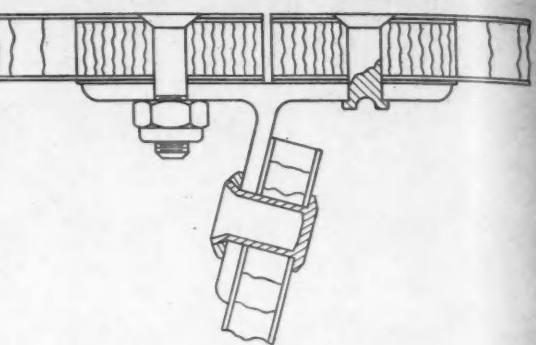
Meaty Ideas from SAE

(Continued from page 36)

the general absence of stiffeners in the sandwich structure. The considerable reduction in the number of such items is one of the major advantages of sandwich structures over conventional types. The choice of rib and frame spacings is determined by a balance between the core weight and the frame weight needed to meet the minimum strength or stiffness requirements.

In making a stress analysis of a Metalite structure, it is obvious that

Fig. 12—Attachment of removable and fixed skin panels of Metalite to the internal structure of an aircraft.



Johnson TAPPETS

By Manufacturers of Tappets Exclusively

GIVE YOU . . .

- ✓ SPECIALIZED DESIGN
- ✓ SPECIALIZED PRODUCTION
- ✓ SPECIALIZED SERVICE

A black and white photograph showing several Johnson Tappets scattered across a light-colored surface. In the center, there is a rectangular text box containing promotional text about the company's history and services.

The millions of JOHNSON Tappets in use today testify to the value of doing business with a concern whose business is tappets. By integrating years of engineering experience and skilled craftsmanship with the production of tappets exclusively, JOHNSON has become recognized as a leading manufacturer of all types of precision tappets. As a result of this specialization, JOHNSON Tappets are of superior design and construction . . . built to improve engine performance, last longer, and give better service.

JOHNSON engineers will give you the benefit of these advantages in discussing the tappet applications in your engines.

Johnson PRODUCTS INC.
MUSKEGON, MICHIGAN
"Tappets Are Our Business"

the bending stiffness of the shell cannot be neglected as it has such a marked influence on the stress distribution. Because the stiffness of the end-grain core in the direction parallel to the faces is low and nearly uniform, the planar and bending properties of the complete panel are virtually constant in all directions. Therefore, the theories for the elastic behavior of isotropic plates and shells can be applied to Metalite by determining the thickness and modulus of elasticity of an equivalent simple plate or shell.

Probably the most important problem of detail design is the problem of making joints between two adjacent panels and between skin panels and their interior supporting members. Conventional riveting in Metalite with a balsa core is not considered to be practical because of the great care that must be used in driving the rivet. Some of the solutions which have been achieved in obtaining satisfactory riveted joints are: the provision of a high strength insert capable of withstanding the driving pressures; and the use of special types of rivets in which the installation forces are reduced.

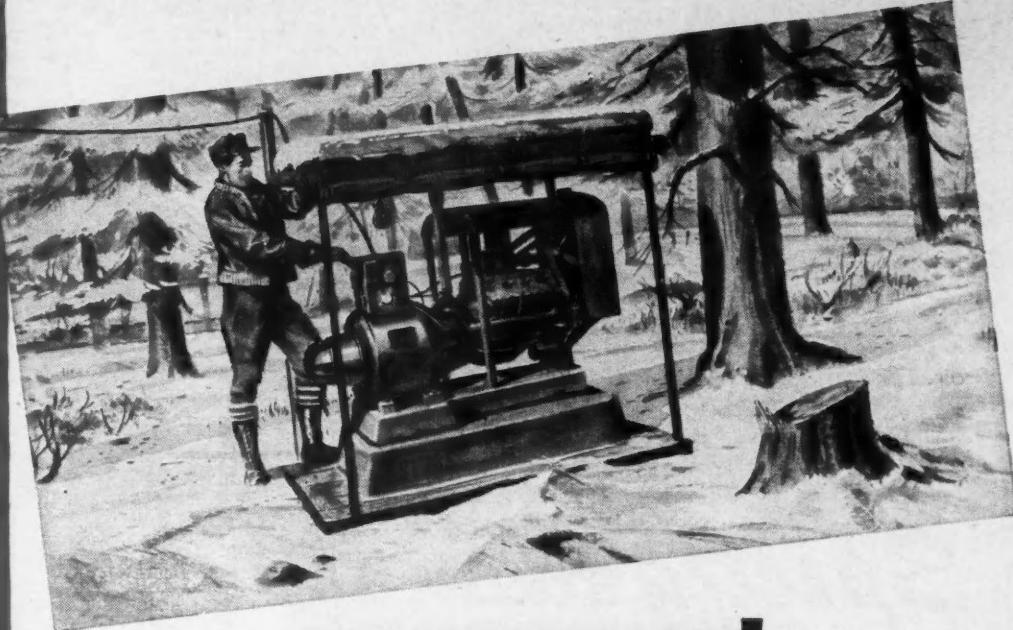
Where the design will permit permanent joining, bonded joints offer a more desirable method of attachment between a skin panel and its supporting structure. These have been successfully made in production by bonding an aluminum alloy tee-section extrusion to the skin panel and riveting the rib or frame web to the outstanding leg of the tee, as shown in Fig. 12. Because of the high strength of the bond and core material (800 psi, min), it is possible to obtain very high tensile as well as shear strengths. This type of joint has been used with complete success between the shell and the four ribs of the stabilizer for the Corsair fighter.

Fuel Injection for Light Aircraft

By George M. Lange,
Fuel Injection Div.,
Ex-Cell-O Corp.

ADVANTAGES of the Ex-Cell-O injection pump fuel metering system for small aircraft engines are as follows:

1. Elimination of manifold icing
(Turn to page 82, please)



PREFERRED!

**—for RELIABILITY . . . for ECONOMY . . .
and for UNIVERSAL FORD SERVICE!**

Whether you *design* and *build* engine-powered industrial equipment, *sell* it, or *use* it, here is a fact so vital that it deserves your most earnest attention:

Nearly all such machinery—whether pumps, electric generating plants, compressors, power units, saw rigs, ventilating and spraying units, or other portable equipment—by its very nature, will spend its service life on jobs where it's "on its own"—where reliability and ready maintenance service are all-important—and where the transportation of motor fuel makes gasoline economy a constant concern.

FORD-BUILT ENGINES PROVIDE UNIQUE ADVANTAGES IN SUCH SERVICE. Ford engine reliability is known and respected the world over. Millions of Ford vehicle owners and

automotive mechanics are thoroughly familiar with Ford engines. Ford economy is famous. And Authorized Ford Service is available in every community of any importance.

Certainly, then, if your power requirements come within the range of 40 to 100 horsepower, you could not choose an engine which would offer you as many positive advantages as Ford.

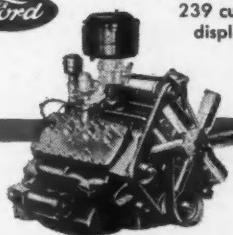
Three Ford-built engines are now available, as shown below. You can buy them singly or in quantity, through any Ford Dealer or from Ford Motor Company. For detailed specifications and dimensional data, write—

FORD MOTOR COMPANY

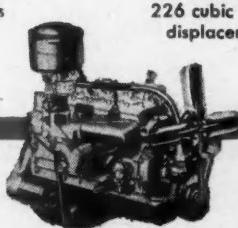
*Industrial and Marine Engine Department
3510 SCHAEFER ROAD, DEARBORN, MICHIGAN*



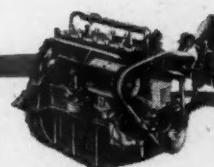
THE 100-H.P. V-8
239 cubic inches
displacement



THE 90-H.P. SIX
226 cubic inches
displacement



THE 40-H.P. FOUR
119.5 cubic inches
displacement



FORD-BUILT ENGINES

FOR INDUSTRIAL AND MARINE POWER

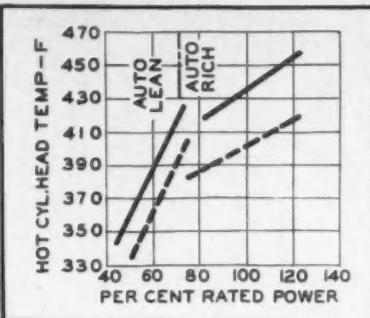


Fig. 13. Test curves show lower maximum cylinder-head temperature with Ex-Cell-O fuel injector.

Dotted line—Fuel Injection
Solid line—Carburetor

2. Good engine idling characteristics since uniform distribution of fuel to all cylinders is maintained even with the minimum quantities required for engine idle.

3. Faster engine acceleration since the mixing of fuel with air takes place at engine cylinder. When fuel and air are mixed and vaporized in the manifold piping, a certain amount of fuel condenses on manifold walls, causing acceleration lag.

4. Lower maximum cylinder head temperatures (see Fig. 13).

5. Better fuel economy since fuel injection permits engine operation with leaner mixtures without danger of overheating individual cylinders.

6. Increased horsepower since engines can be operated with higher average cylinder head temperatures, higher absolute manifold pressure and with a cooler induction system (see Fig. 14). Good full throttle operation is obtained

since fuel atomization and final vaporization take place where heat for vaporization is always present.

Specify STROM BALLS



Hand Gauging
of large diam-
eter Strom Balls
before packaging

When you specify Strom Balls you are sure of getting balls with the highest obtainable degree of finish, sphericity, precision—balls that give the very highest quality of service in any bearing equipment. This high degree of perfection is the result of Strom's concentration for a quarter of a century on metal balls exclusively and the perfection of the processes and workmanship necessary to produce them. Strom Steel Ball Company, 1850 South 54th Avenue, Cicero 50, Illinois.

Strom BALLS  Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

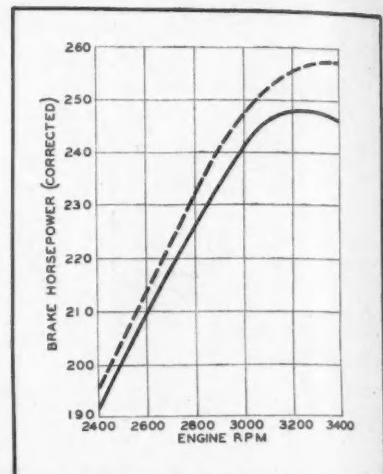


Fig. 14. Test curves show increased hp with fuel injector.

Dotted line—Fuel Injection
Solid line—Carburetor

with one-half in. manifold pressure drop, as compared to one and one-half in. drop recommended for best engine operation with carburetor equipment.

7. Reduced maximum cylinder head temperatures increases valve, piston and piston ring life.

8. Lower cylinder head temperatures simplifies baffling required for adequate engine cooling.

9. It is possible to design a flatter engine with fuel injection.

The Propeller Aspect of Practical Problems in Reducing Noise in Personal Planes

By Leslie J. Trigg,
Chief Engineer,
Sensenich Bros.

THE ultimate solution to the propeller noise problem must come through the absolute reduction of propeller tip speeds. This may only be accomplished through the use of slower turning engines, engine-propeller reduction gearing, multi-bladed propellers, wider blades, or a combination of these. Since propeller power absorption increases more rapidly with increases in propeller diameter than it decreases with proportionate decreases in propeller rpm, reductions in propeller tip speeds may be achieved through the utilization of propellers of larger diameter rotating at more than proportionately lower values of rpm without incurring losses in propulsive efficiency. (Turn to page 84, please)

head
fuel
with
of
ines
rage
ab-
h a
14).
ned

THE HOLE STORY . . . *fast*

The new No. 212 Bryant Automatic Internal Grinder roughs and trues and finishes and stops automatically. It requires a minimum of operator attention. It has 9" maximum swing — 3" grinding traverse — 12" total wheel traverse.

The wheelhead shown is the Bryant Hi-Frequency direct drive motor built to operate at speeds up to 100,000 R.P.M. The wheelhead is carried on a hardened and ground cylindrical slide.

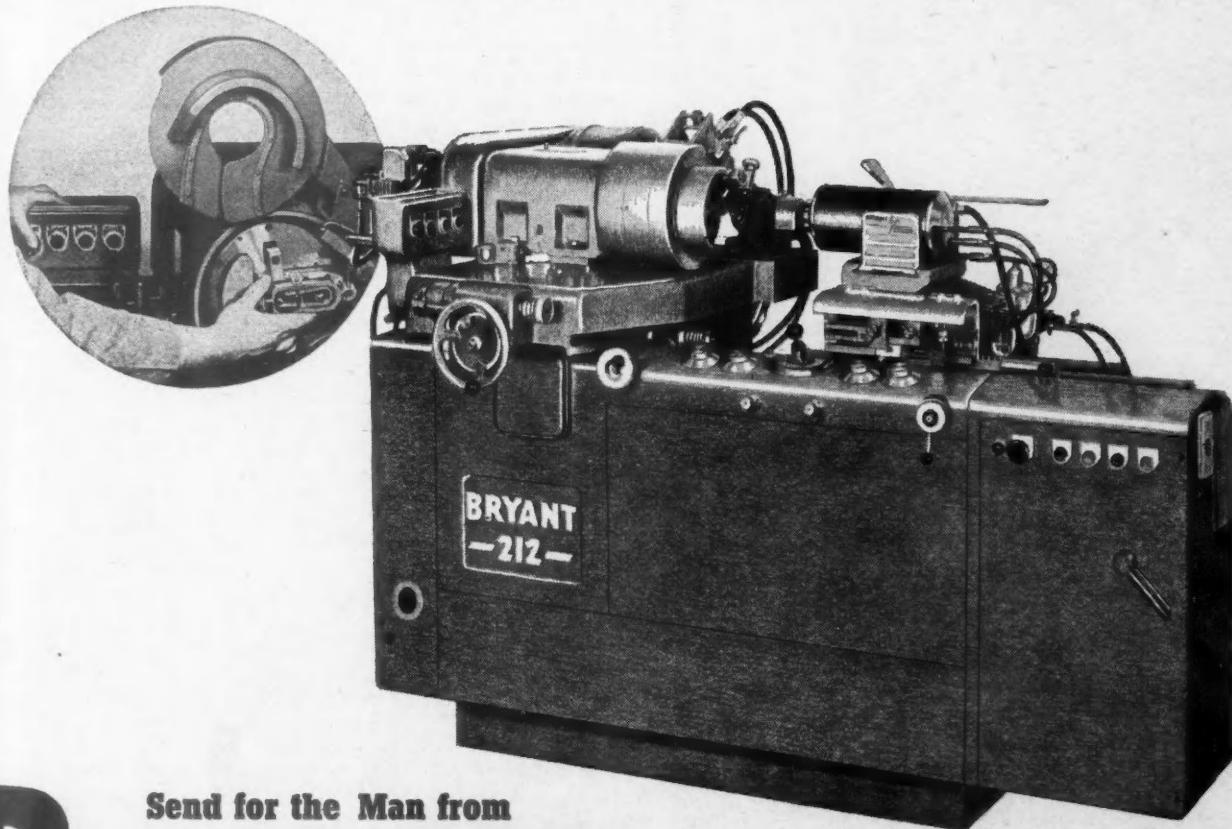
The cross-feed is in the work table which rides on anti-friction bearings and is controlled by a precision lead screw. The work spindle is mounted in preloaded ball bearings and is dynamically balanced to assure precision work.

An electrically controlled hydraulic system provides smooth operation and simple cycle change.

Automatic work sizing is accomplished by any of three methods: by a plug gage mounted in the work spindle; by a diamond contacting the bore; by the wheel trueing diamond.

Operator attention is further minimized by such features as convenient grouping of simplified controls and automatic pressure lubrication.

For a better product and a better profit, ask for further information on the Bryant No. 212 Automatic.



Send for the Man from
BRYANT  **BRYANT CHUCKING GRINDER CO.**
SPRINGFIELD, VERMONT, U.S.A.

ficiency. Further reductions in tip speeds may be realized by utilizing propellers incorporating a greater number of blades, or by using wider blades and decreasing the diameter accordingly, although doubling the number of blades will permit only approximately a 14 per cent reduction in propeller diameter and doubling the width of blades will permit only approximately a 12 per cent reduction in propeller diameter, if the same values of blade section angles of attack are to be maintained. In each case the general level of propeller efficiency will usually be decreased.

An increase in the number of blades

or in the blade width will usually result in an increased variation in propeller rpm with variations in airplane airspeed for fixed pitch propellers. If the number of blades exceeds four, use of a variable pitch propeller is almost mandatory for airplane cruising speeds in excess of 130 mph if the general performance of the engine-propeller combination is to be acceptable. The increased cost of multi-bladed propellers must also be considered.

The utilization of a slower rotating propeller, either through the use of reduction gearing or through the use of an engine having a relatively low rpm rating, along with the use of a two

bladed propeller incorporating extremely wide blades has reportedly shown promise in effectively reducing the noise level. Use of a three bladed propeller and the corresponding permissible diameter reduction has reportedly shown appreciable improvement from a noise standpoint when installed upon an engine which normally utilizes a two bladed propeller.

Considerations in Valve Gear Design

By Vincent C. Young,
Chief Engineer,
Wilcox-Rich Div.,
Eaton Manufacturing Co.

IN THE course of experimental work it has been very forcibly brought out that if the optimum results are to be obtained, increased accuracy must be attained in the manufacturing of cams. It is slow, tedious and relatively inaccurate to determine velocity and accelerations of the actual cam from measurements of lift per degree. This is seldom carried out in its entirety and many hours are spent in comparing test data with a theoretical or drawing diagram, only to find that a slight inaccuracy makes the analysis almost worthless. To make such studies worthwhile by working with actual and not theoretical diagrams, the true cam profile can be very rapidly checked by simply taking an acceleration and velocity reading with an oscilloscope, the pick-up of which has been carefully calibrated and the check made under conditions that reduce the possibility of depicting motion, other than that resulting from the cam profile, to a minimum. This is accomplished by operating at very low speed and with minimum parts between the pick-up and the cam, thus eliminating the effect of deflections.

Engine Trouble Shooting In the Air

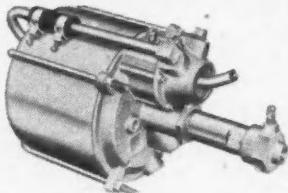
By John E. Lindberg, Jr.,
Staff Engineer,
Pan American World Airways,
and Clifford Sackett,
Chief Engineer,
Lindberg Instrument Co.
PAA Consulting Engineer on Engine
Analyzer Project.

THE engine analyzer described in this report provides continuous visual analysis of the complete aircraft power plant during flight by means of a cathode ray tube and related circuits. On the analyzer scope, the flight engineer can examine at any time during flight the characteristic patterns of ignition system performance, changes in mixture distribution, faulty fuel injector operation, synchronization between magnetos and between engines, engine roughness, engine vibration and, if desired, hydraulic and electrical accessories performance. These patterns

(Turn to page 86, please)



Bendix HYDROVAC 1ST IN POWER-BRAKING



precision machined on SOUTH BEND LATHES

The Bendix Hydrovac power braking unit, proved by more than a million installations and billions of miles of service, is one of many outstanding technical achievements by Bendix Aviation Corporation which played important roles with our fighting forces and are now contributing to peace-time enterprise. Hundreds of South Bend Lathes are used by Bendix Aviation Corporation in their experimental laboratories, toolrooms, and manufacturing departments for the development and production of their products.

At left: Technician Henry Janowski, Experimental Department, Bendix Products Division of Bendix Aviation Corporation, using a 16-inch swing South Bend Precision Toolroom Lathe to machine the end plate for an experimental Bendix Hydrovac.



Building Better Lathes Since 1906

SOUTH BEND LATHE WORKS
512 EAST MADISON STREET • SOUTH BEND 22, INDIANA

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

FINISHING WASHERS

Diamond G makes a full line of hollow and flush type finishing washers. Available in all finishes and types of metals.

SPECIAL WASHERS AND STAMPINGS

A complete range of sizes are available in Diamond G special "C" washers. Unusual stampings of all kinds produced in Garrett's modern stamping plant which turns out millions of stampings.

SPRING STAMPINGS

Garrett's modern facilities for stamping and precision heat treating make it possible to produce spring stampings of the highest quality. Producing special spring stampings to exact specifications in an amazingly short period of time is a specialty of Garrett's.

SPRING WASHERS

Diamond G has built an outstanding reputation for producing a wide variety of spring washers. They offer manufacturers an excellent source of supply for special shaped, curved, dished and cupped spring washers.

FLAT WASHERS

Outstanding in the Diamond G line of products are the many flat washers made by Garrett's. It offers industry a quick and dependable source of a complete line of flat washers including SAE, machine-screw, and aircraft washers in all sizes, thickness, metals and finishes. Garrett's also produce a complete line of snap, space and retainer rings for all types of industrial installations.

HOSE CLAMPS

Garrett's line of hose clamps includes both types to provide the manufacturer with the answer to his problems. The Diamond G Multi-Clamp is the ideal clamp of a thousand uses which can be used on automotive, hydraulic, pneumatic, electronic and aviation installations. The Diamond G Auto-Seal Clamp is truly the all-purpose economy clamp for every industrial use... is rugged and provides a tight seal on every joint.



DIAMOND PRODUCTS

detect, locate and identify malfunctions and imminent failures that may occur during operation, and also permit the flight engineer to adjust the engine for optimum performance. Engine patterns can be examined singly for an individual cylinder or simultaneously for all cylinders.

Ignition system patterns show condition of spark plugs, cables, distributors, condensers, coils, breaker points, indication of mixture distribution and malfunctioning of injection system. Synchronization patterns show timing between magnetos on an engine or speed synchronization between engines. Engine vibration patterns show char-

acteristics of combustion (knock or detonation), seating of valves, seating of injector valve, distortion of cylinders and pistons, and failure of piston rings and wrist pins. Hydraulic and electric accessory patterns show condition of these components.

It is estimated that the increased aircraft utilization made possible from the flight use of the engine analyzer will pay off the costs of purchase, installation and transportation of the equipment in flight. Further gain anticipated from the use of the engine analyzer in flight are increased flight economy, safety and schedule regularity.



Unusual Application of Usual TUTHILL Quality Springs

HERE'S an example of special types of Springs made by TUTHILL for unusual application. In this instance, they are applied by the United Mfg. Co., Bedford, Ohio, to their Farm Wagon shown.

These springs were specially designed for this type of job and are made of "S" shaped steel. All TUTHILL Springs demonstrate their toughness, strength and resilience—under all road and load conditions.

Tuthill makes Leaf Springs in standard and special types. Submit your Springs problems to our Engineers.



**TUTHILL
SPRING CO.**
760 W. Polk St.
CHICAGO 7, ILL.

Quality Leaf Springs for Sixty-seven Years

The Manufacture of Precision Castings

By G. Vennerholm,
and E. Ensign,
Ford Motor Co.

ALTHOUGH each individual precision casting method offers merits which can be of value to the automotive industry, a combination of two or more of these can frequently be of optimum utility. Particularly is this so when the production advantages of the die casting or permanent mold casting method can be combined with the design advantages inherent in the investment or plaster molding method. Such combinations found widespread use during the war in the manufacture of superchargers, both shrouded and plain, and similar parts for the aircraft industry. In general, the method is to make a die or permanent mold and insert a ceramic or plaster core after which the cast is made in the conventional manner, casting either statically, centrifugally or under pressure. With some designs it is difficult or impossible to make the plaster core in one piece due to back draft in which case the core may be broken down into castable units and assembled into the permanent mold. In the past, sand has been used for the core material but it did not give the desired dimensional tolerances nor the surface finish to the casting. The use of plaster cores in permanent mold offers a large field in-precision casting.

Magnesium-Zirconium Airplane

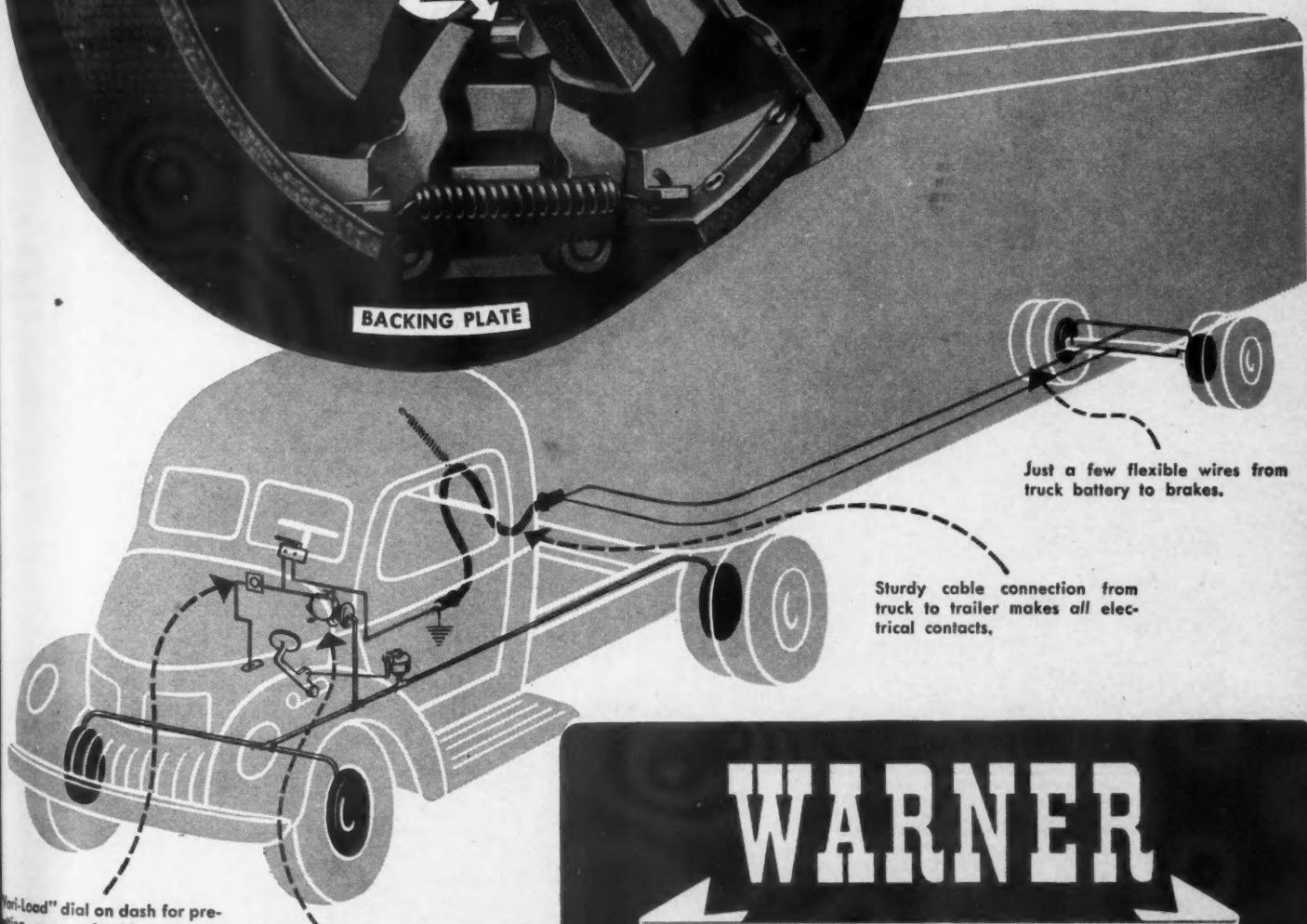
Now being built by the British is a four or five-passenger, single-engine airplane with the air frame made substantially of high-strength zirconium-magnesium alloy. The first machine, a prototype model, is to be riveted, but a second will be argon-arc welded. Simplicity of construction will be used throughout so that only one-third of the usual number of parts will be needed. The fuselage, for instance, will consist merely of a thick sheet of magnesium-zirconium alloy bent to form a tube, thus eliminating the complication of frames and stringers. Controls of the craft will be simplified to enable the average motorist to learn to fly the airplane in two or three hours.

Positex Rubber Latex Has Positive Charge

Processes by which negatively charged rubber latex can be converted into a positively charged emulsion have been worked out by Dr. C. M. Blow, Wool Industries Research Association, Great Britain. This reversed charge latex, called Positex, is expected to have valuable applications in the rubberization of fabrics since textile fibers are negative to an aqueous medium. Two grades of the reversed charged latex are commercially available at the present time, vulcanized and unvulcanized.



The Warner Electric Brake is a simple mechanical brake, operated by an electro-magnet and armature disc. Each wheel is a complete brake unit. The braking power is generated within the brake itself. A wire to the battery and a controller complete the system — famous for its simplicity.



Controller operates trailer's electric brakes in unison with truck's hydraulic or air brakes.

WARNER
ELECTRIC BRAKES

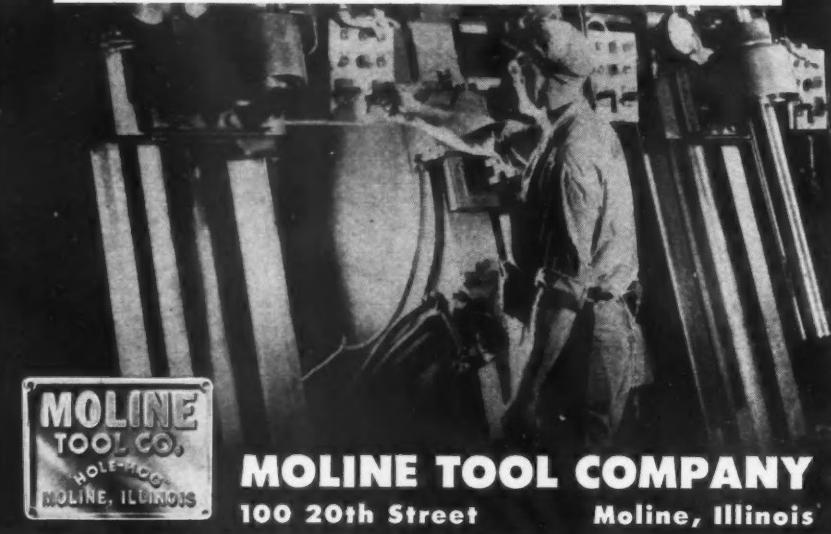
If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

• BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT . . .

then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

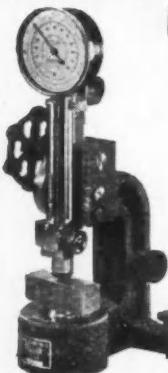
For YOUR special problem, go "HOLE-HOG," write us for any information you may need.



MOLINE TOOL COMPANY

100 20th Street

Moline, Illinois



HARDNESS TESTING

The STANDARD SCLEROSCOPE (Now highly Improved) for more than twenty years has made good and is still used for doing the world's hard work in testing. In general use for specifications purposes. Simple, Sturdy, Comparatively Inexpensive. Illustrated bulletins free. FOR QUALITATIVE AND QUANTITATIVE HARDNESS MEASUREMENT, under Static Pressure, the MONOTRON is the only machine now available. Operative up to over 2000 Diamond Brinell. Avoids errors due to spring in test pieces. Takes readings with the load on, avoiding reversal lash errors. No setting to zero. Operates at highest Speed. Has solved many old laboratory and shop problems. We also make the Durometer for testing the hardness of rubber. Comprehensive bulletins free.

THE SHORE INSTRUMENT & MFG. CO.
Van Wyck Ave. and Carl St., Jamaica, New York, N. Y.
Agents in all Foreign Countries

PJ .. for over 40 years
THE PIONEER
MANUFACTURER OF
AUTOMATIC CHUCKING EQUIPMENT
POTTER & JOHNSTON MACHINE CO.
PAWTUCKET, RHODE ISLAND

Electronic Ignition

(Continued from page 37)

are present, such as the contact breaker, and there is only one rotating shaft as a moving part; 4. Conservation of scarce materials—platinum, cobalt, nickel; 5. Low cost of maintenance and repairs due to absence of wearing parts; 6. Simpler radio shielding requirements; 7. Less space and weight, particularly of driving mechanism; 8. Greater uniformity of the parts and assembly for different engines and numbers of cylinders; 9. Insensitivity to high altitudes; and 10. One drive required regardless of number of cylinders.

The admitted disadvantages are: 1. Dependence upon a separate source of energy and circuits carried in the plane itself; 2. Location of transformer apart from engine; and 3. Longer time to start. Two to three minutes are required for heating of tubes.

Considerable research and development work will be needed in order to perfect this system. The Bosch people believe that:

1. Coils smaller than those presently made must be developed for mounting directly on the plugs, to eliminate corona, to make higher altitudes possible, and to overcome other known deficiencies.

2. The life of the carbon brush distributor (now 150 hr), and of the gas filled tubes (now 100 hr) must be improved.

3. The lamp and photo-cell must be improved to withstand the vibration when mounted on the engine.

AUTOMOTIVE

and

AVIATION

INDUSTRIES

Goes into

Leading

Plants in the

Automotive

and Aircraft

Industries

Temperature Control

(Continued from page 40)

the Thermo-Matic system can be arranged to maintain the temperature of perishable cargo at any desired level. It may be used independently with some other form of heating and control; while the booster heater can be installed in any vehicle either to supplement its own ventilating system or to serve as a means of elevating engine operating temperature and facilitating cold starting.

At the present time this installation is intended solely for cold weather operation and is not arranged for summer air-conditioning.

Classified Advertisement

PORTABLE HEATER SALE: (Original cost \$583). Powerful Stewart-Warner 100,000 BTU gasoline-burning ground-type Aircraft Heaters. Complete with 1½ hp. engine, blower, supercharger, and flexible ducts. Positively rebuilt and guaranteed \$195 freight prepaid in USA. BERNSTEIN BROTHERS (since 1890), Dept J, Pueblo, Colorado.